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VOL LVI 5 APRIL 1947 No 1447

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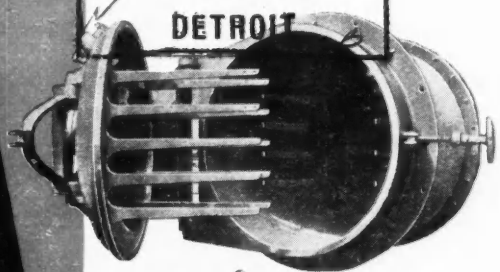

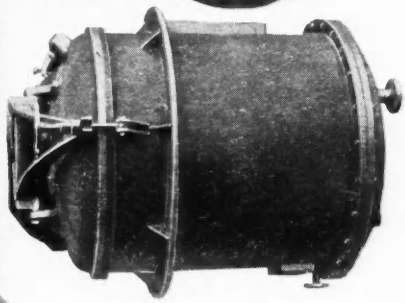

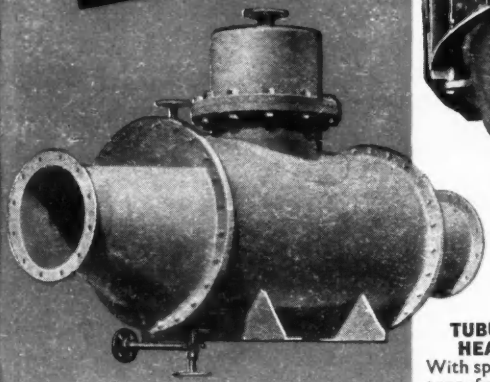

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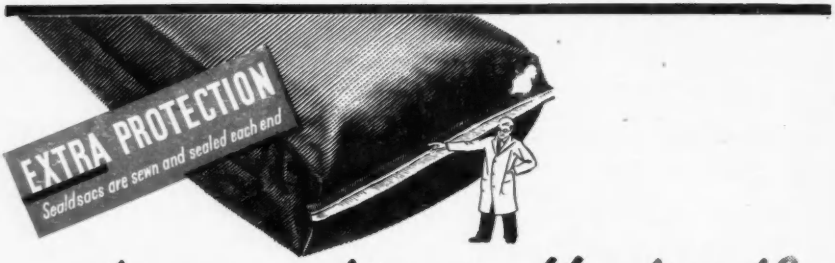

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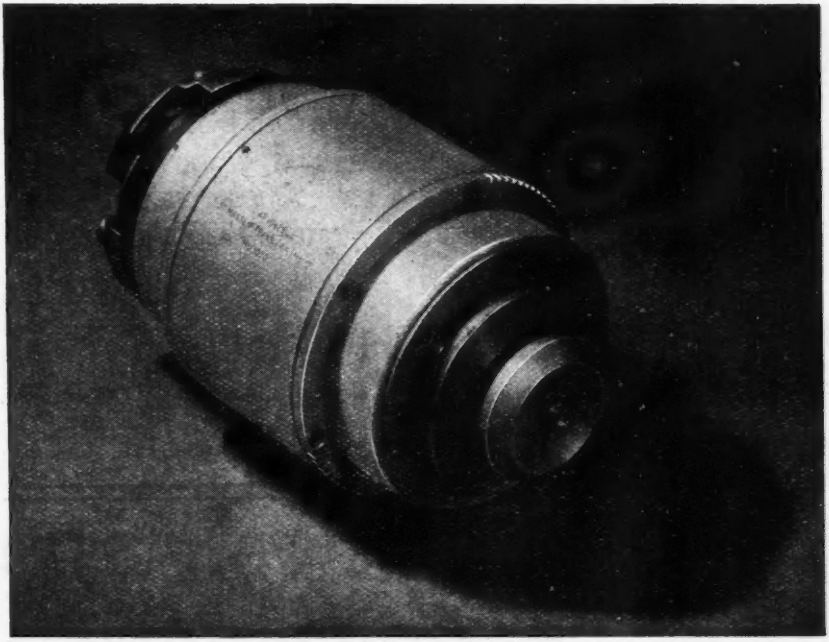

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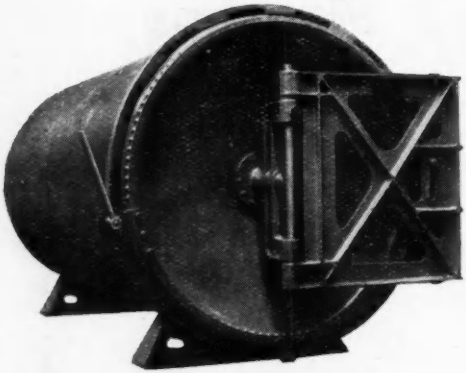

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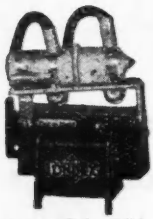

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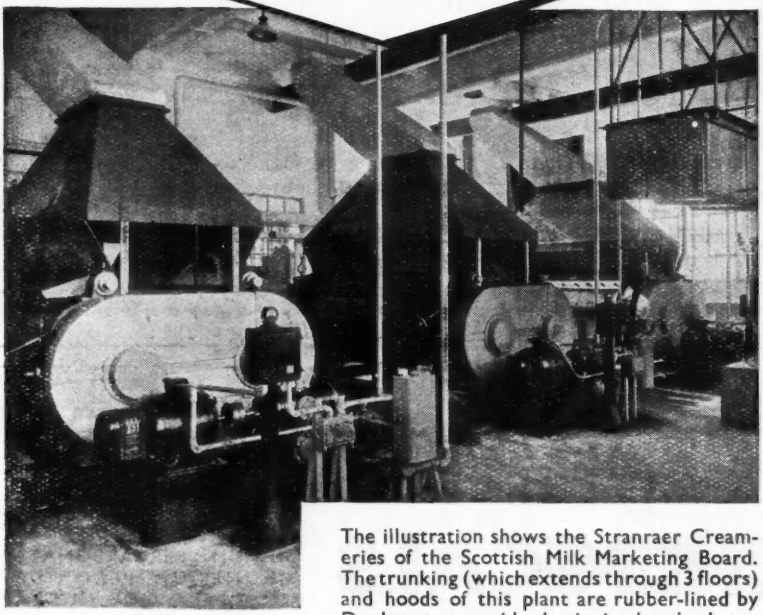

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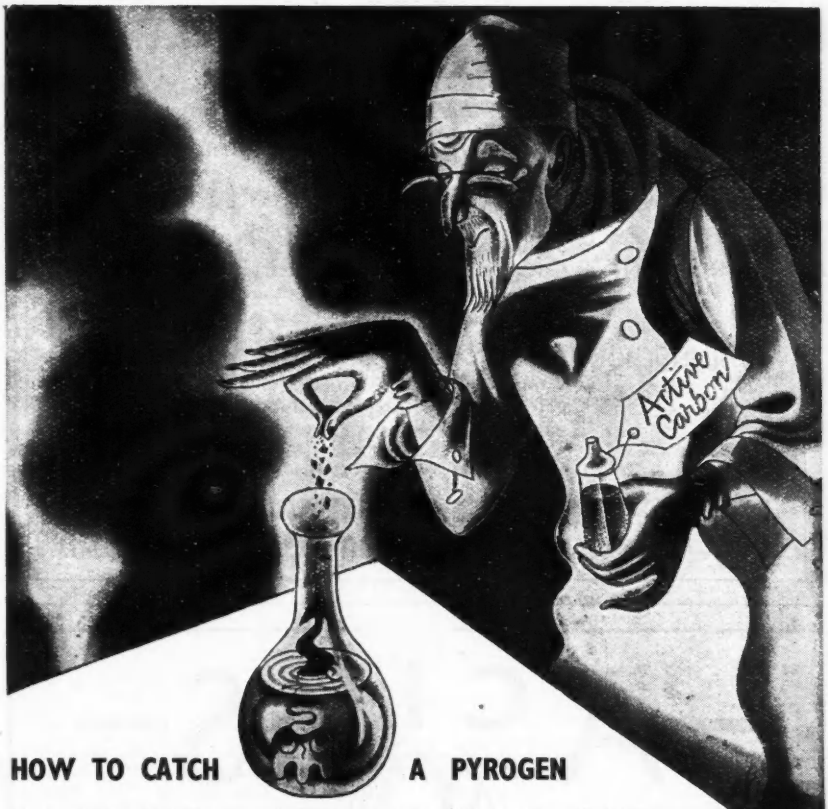

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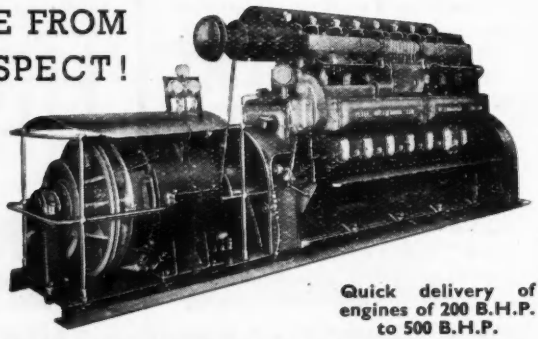

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The Alkali Inspectors' Report

ONE of the valuable publications of which the war has robbed us has been the Report of the Chief Inspectors of Alkali works. The gap of six years since the last appearance of the annual reports has now been bridged to some extent by the issue of a consolidated report covering the whole period. Like many other organisations, the Alkali Inspectorate was diverted to war work and to a very large extent the normal work of the staff had to look after itself. It is a well-deserved tribute to the management of chemical works that the Chief Inspector for England and Wales pays in his comment that " managers and others concerned in the operation of chemical processes have acquitted themselves really well in maintaining production and keeping their plants in reasonably good working order in spite of many and great difficulties." These difficulties are known to our readers; to shortage of labour and materials, was added enemy action and the need for maximum output. It is not alone in the chemical industry that this tribute is deserved; by and large British industry performed wonders during the war in maintaining efficiency. The key-note of modern industry is increased production with greater efficiency. In every industry the care that is taken to watch just those sort of things that are the care of the Alkali Inspectors and of the Factory Inspectors is a measure of the efficiency with which industrial operations are conducted. Cleanliness, safety, the prevention of the discharge of noxious gases and effluents, with the preservation of the amenities in which people live and work are outward signs of inward efficiency.

Nevertheless, it is inevitable that the condition of maintenance of some plants will have deteriorated. It is unfortunate that it should be so, because maintenance can represent a very serious charge in the cost of production. Not only does maintenance in itself add considerably to the cost, but as the plant becomes less well maintained production decreases and the less efficient use of materials and labour adds to the cost of manufacture. Maintenance is the root of good house-keeping in industry; cleanliness, we have been assured on very high authority, is next to godliness, but we are not sure that good maintenance does not come first of all in the list of industrial virtues. Without it, efficiency is impossible. It was once remarked to us that " So-and-so could make benzole out of a tin can and a bit of pipe "—but not if the tin can had a hole in it.

Thus, now that the Government inspectors

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are back in harness again at their normal work, they will once more come to the help of industry not only as policemen to see that the laws of good housekeeping are not broken, but to give advice and assistance where it is needed. There is much to be done to bring back some works into a good state so that efficiency may once more be secured. There are improvements that have become overdue, but which could not be made on account of the war. New processes have been set up that may lead to the escape of noxious gases and that require to be tightened up in this respect. We were interested to observe a reference, too, to " the investigation of smoke problems " in the more important duties of the Alkali Inspectorate. The emission of smoke from colliery spoilbanks has for some time been one of the matters over which the group has kept an eye. There is little doubt that following the issue of the report of the Fuel and Power Advisory Council on Domestic Fuel Problems, the Government has resolved to take action to eliminate smoke production from the domestic hearth as well as from industrial works. Smoke means waste, inefficiency, and ill-health; it will be of interest to see how far the investigation of smoke problems by the Alkali Inspectors leads them into the same field. There is little doubt that the total emission of noxious gases from all works inspected is not more than an insignificant fraction of the total deleterious gases and vapours that arise from burning raw bituminous coal. In this respect, valuable as it is and essential as it is to prevent local nuisance, it has often seemed that the whole business of the Inspectors of Alkali, is rather akin to casting out the mote and forgetting the beam.

A great deal of attention is now being paid to the installation of new works. Nearly every Ministry seems to have a hand in it and the freedom of the individual is becoming less and less. There are certain zones in which he cannot put his works; the Ministry of Town and Country Planning will attend to that. There are important considerations regarding the use of fuel to get the maximum of fuel efficiency; the Ministry of Fuel and Power and the New Works Committee of the Fuel Efficiency Committee will give every assistance in that respect. There are all kinds of labour restrictions for which the Ministry of Labour comes into action. The education of young people must be safeguarded; the Ministry of Education watches over that. We do not argue against these things; the advice and help that can be secured from Government departments is often invaluable and full use should be made of it. It illustrates this trend of the encroachment (if that be the right word) of Government on industry that the Alkali Inspector should also stake a claim to be taken into the councils of those who are engaged on new ventures: " The siting of a new works," we read, " is an important factor from the standpoint of economical working, but its effect on the well-being of the community should also be carefully considered, especially if there is a possibility of noxious or offensive gases being discharged. Too often has plant been erected without adequate provision being made for dealing with noxious or offensive gases, and the condition has only come to light after complaints have been made and damage perhaps caused. . . . When considering applications for the establishment of works, planning authorities should take expert advice and insist on the installation *at the outset* of suitable means whereby dust and gaseous emissions may be controlled."

Turning to particular items in the work done by the Inspector and his staff, one notes that SO_2 and chlorine seem to be the gases that cause most trouble, while dust emission is also a great—perhaps even a greater—offender.

It is interesting to observe that the Chief Inspector advocates the general carbonisation of bituminous coal. His paragraph might well have been looked over first by a fuel technologist for he urges that " the available supplies of bituminous coal should be reserved for processing only, whereby the more valuable constituents would be recovered and smokeless fuels produced." The position here is that shortage of labour prevents sufficiently rapid building of coke ovens and gasworks to produce the smokeless fuel required quickly enough to implement the Government's plans for smoke abolition; that there can and probably will be made available large quantities of anthracite and smokeless coals for the purpose having a volatile content too low to permit of economic carbonisation; and that not all bituminous coals by any means possess coking properties. In spite of these limitations on a policy of carbonisation of *all* suitable coals, we should still support any move to increase the quantity of coal carbonised very substantially.

NOTES AND COMMENTS

F.B.I. Statement

IT is perhaps the measure of our present economic plight that, as always in our hour of crisis as a nation, the lion is preparing once more to lie down with the lamb. There may be no governmental coalition, but there seems to be an increasing coincidence of views in otherwise dissentient quarters as the best means to the end of national salvation. Take for instance the interim statement of the Federation of British Industries which we summarise in another page. The opinions expressed therein and the practical measures advocated will be found to concur more than they differ from those already set forth in the manifesto of the Trades Union Congress, which we would like to take as indication that capital and labour at last have come to realise hat their interests are indivisible but which we may certainly take to mean that ideology on either hand is wisely being regulated second place to reality. The significance of this truce to faction—a resurrection of that spirit of unity which won us the war—will not, we trust, be lost upon Mr. Atlee and his colleagues. It is for them to seize upon it as a heaven-sent signal that, given the lead which they alone can give, employers and employees are ready to follow. Even the F.B.I.—stronghold of free enterprise—accepts the necessity for the national economy in the present emergency to conform to an overall plan. "But," as its statement points out, "the idea that a central plan can be enforced by a host of detailed controls is false. It will not work. A technique must be developed by which the responsibility for carrying the broad plan into effect is diffused through industry." And, we would add, that goes for both sides of industry—worker and manager; capital and labour must each shoulder a share of that grim responsibility.

Third in Command?

THE appointment last week of Sir Edwin Plowden as Britain's Chief Planning Officer for industrial re-development will be welcomed by all who have had experience of the results which inexpertness and divided interests in Government circles have lately produced. As a former chief of the Ministry of Aircraft Production in war and as an active director of undertakings in which failure to get things done would have had unpleasant financial repercussions which no amount of oratory could disguise, Sir Edwin should be well equipped to bring a breath of realism into the relations between planners and producers. And at 40 he may, one hopes, have retained some of the youthful impatience with indecision and "wait and see" philosophy to clear away some at least of the impediments still strewing the path to industrial expansion. The approval with which the Prime Minister's announcement was received would, however, have been much more wholehearted had he not had to reveal that Sir Edwin's chieftaincy is subject to two sets of overlords—the Cabinet and the individual Ministers. Field Marshal Lord Montgomery might conceivably have wrested victory in such an unpropitious setting. The future will reveal whether Sir Edwin Plowden is capable of performing a job of almost equal magnitude and complexity, in which he deserves the unstinted co-operation of fellow industrialists.

Oil Tanker Refloated.—The London oil tanker "Diloma," of 8156 tons, which, with a cargo of benzene, went aground off Sunderland recently, has been refloated.

Alf: ***Lumme, it's as 'eavy as lead.***

Research Must Expedite Recovery

Industrialists' View at Birmingham Conference

OPENING the afternoon session of the Federation of British Industries Conference on Industry and Research—the first of a series of regional conferences—at the Queen's Hotel, Birmingham, last week, Sir Edward Appleton, Secretary of the Department of Scientific and Industrial Research, congratulated the F.B.I. on the very valuable work it was doing in arranging this and similar conferences.

The Midlands, he recalled, had been responsible for many contributions to the history of British industrial development through the application of science. It was a Birmingham man, John Roebuck, who by the introduction of leaden reaction chambers in the manufacture of sulphuric acid reduced its price sufficiently to create the British export trade in heavy chemicals. It was in the Midlands that Dud Dudley first used coal, and later Abram Darby, coke in the production of pig iron. Watt also came to the city in 1774 and began with Boulton the honourable association of Birmingham with the development of the steam engine. These men and other pioneers who had distinguished themselves in the Midlands—Erasmus Darwin, William Murdoch, John Baskerville and Priestley—had in common a broad understanding of the scientific approach.

Function of Research

Science was a vast reservoir of organised knowledge accumulated from controlled and reproducible experiments; through research new knowledge was continually being added. The first need of every industrial firm, if it was to deal satisfactorily with the problems of our changing world, was that it should have a pipeline to this reservoir through which it could draw on the scientific knowledge available in Government laboratories, research associations and the universities and technical colleges. A small firm perhaps could do no more than this, that is to say it could not do more than employ one or two men qualified—not to undertake research—but to examine the scientific knowledge already available and see how it could best be turned to the firm's advantage.

Larger firms could afford to do more and could afford to look further into the future and by carrying out more original and fundamental research could aim at bigger returns from a larger investment in research than is possible with the smaller concerns.

Nevertheless, it was the universities with their tradition of freedom which were the natural home of research of this type.

"I firmly believe," said Sir Edward, "that the universities and technical colleges, not only because of the scientific and technical knowledge which flows from them, but also because they are the source of qualified scientific and technical workers, must be the foundation of the scientific life of any region.

Co-operative Action

" At the same time, I am convinced that the most valuable support that can be given to industry in meeting its particular needs for scientific knowledge lies in the encouragement of co-operative action through the research associations. Apart from the research they carry out, the associations form centres of information and advice to their members for dealing with their day to day difficulties. This, together with the rights of members to propose items for investigation, to have the use of the patents taken out, to submit problems for solution and to consult the associations whenever they wish, has convinced us in D.S.I.R. that the associations' scheme provides the best single method of bringing research and scientific knowledge within the reach of smaller firms. There may be better methods but we have not yet heard of them."

It was most important that we should make full use of the knowledge which already exists. There was a vast amount of scientific knowledge accumulated before and during the war and ready to be adapted. D.S.I.R. had therefore set up at headquarters an Intelligence Division to act as a guide to inquirers.

Sir William Larke, chairman of the F.B.I. Industrial Research Committee, speaking at the morning session, urged that the attitude of " critical scientific inquiry "—the Oxford Dictionary's definition of research—must be stimulated in all its applications to industrial processes and operations, many of which were still traditional and capable of simplification. Where no co-operative industrial associations already existed, *ad hoc* committees, he recommended, should be set up to ensure the fullest exchange of information and experience. Technological research into the use of raw materials was capable of effecting valuable economies, and by local research many indigenous raw materials might be employed to supply deficiencies.

Other speakers who contributed to the morning or afternoon sessions of the conference included Dr. J. W. Jenkin, president of the Institute of Metallurgists, Mr. F. G. King, technical director, Dunlop Rubber Co., Ltd., and Mr. J. G. Pearce, director of the British Cast Iron Research Association.

Chemical Employers' Dinner

Distinguished Guests

REFERENCE to the splendid record of the chemical industry in the country's Battle of Production, was made at the first annual dinner since before the war of The Association of Chemical & Allied Employers at the Mayfair Hotel, London, on March 26.

The dinner was attended by many distinguished people in the industry.

Dr. W. H. Garrett, vice-chairman of the Association of Chemical and Allied Employers, said it was an unusual pleasure to propose the toast of " The Guests " because it was eight years since anyone had had the opportunity of welcoming guests to that annual gathering. He caused much laughter when he said, " Since the last gathering of this kind, there has intervened the war years which have helped us to build up the fortitude necessary to face the rigours of these years of peace."

Dr. Garrett then went on to welcome the guests individually. They were particularly pleased to have Sir Godfrey Ince, the Permanent Secretary to the Ministry of Labour. He was well-known to them as the Director of Manpower during the war. They were also glad to have Sir John Forbes Watson, Director of the British Employers' Confederation, with them, and others he particularly mentioned were Sir Frederick Bain, deputy chairman of I.C.I., and President-Elect of the F.B.I., " who did great service to our industry during the war by controlling the chemical industry from the manpower angle "; Mr. L. P. O'Brien, chairman of the Association of British Chemical Manufacturers; Mr. J. Davidson Pratt, Director of the A.B.C.M.

They also welcomed Capt. Mark Hewitson and Mr. J. Gilmour, and the following four retired members of the Executive Board, Messrs. W. Collison, J. M. Horrocks, H. Gibbon and J. Johnson, who had given long and faithful service to the Association and the Council.

He then welcomed the ladies.

A Bureaucrat Defined !

Sir Godfrey H. Ince, Permanent Secretary to the Ministry of Labour, replying, soon had the company laughing by saying, " I am a bureaucrat. At least that is the term I and my colleagues in the Civil Service are referred to quite frequently in some quarters. Being a bureaucrat, I thought I ought to know what it was so I looked it up and this is the definition I found: " One of a graded series of officials in a centralised system of government responsible only to their chiefs and controlling every detail of public and private life."

Sir Godfrey went on " I must say I was rather shattered and my first inclination was to send in my resignation. The phrase 'one of a graded series ' sounded to me like an egg and many people may think a bad egg at that."

He thanked Dr. Garrett for the generous terms in which he had proposed the toast.

Speaking of the guests and the firms they represented, Sir Godfrey described the I.C.I. as " a great public enterprise " and added, " I put the emphasis on enterprise because it is enterprise of all kinds we need if we are going to emerge from our present difficulties."

Co-operation with Workers

He called for even closer co-operation between employers and workers, declaring, " The employers' organisations and the trade unions were never more important than they are today and never have they had a greater responsibility. They are free institutions. We fought the war for the preservation of free institutions and one of the things which has emerged from the recent debate in the House of Commons was that to have a planned economy, there had got to be devised an economy which would enable the country to recover its industrial greatness and at the same time preserve its free institutions.

" In the solution of that problem, the Joint Industrial Councils, the joint bodies of employers and the trade unions had an important part to play."

In the years between the two wars, a system of collective bargaining was built up in this country which had stood the test of war and was the envy of the world. He asked that full use of manpower be made in the chemical industry, and put the question: " Were they doing everything they could to increase output? Were they doing everything to further the interests of the country?

" If you are facing these questions and taking action on them, then our free institutions will show the way by which, under democratic means, we can win the battle of production.

" Seven years ago this country was fighting for its life against the greatest military might the world has ever known.

" Today we are again fighting for our lives —the economic life of this country.

" As we won the Battle of Britain so we can also win this Battle of Production, and we can do that if we adopt for it the motto

of the R.A.F.—' Through work to the stars.' "

Sir John Forbes Watson, Director of the British Employers' Confederation, proposed the toast of " The Association " and referred to the splendid production record of the chemical industry.

It had been said if we were to get back to our 1938 standard of living, we had got to increase exports by 75 per cent. The chemical industry's exports had increased 60 per cent over 1938, which was within striking distance of the Government's aim and a record which few industries approached.

Sir John asked what was going to happen when the dollar line of credit was exhausted.

" That will be the crisis," he said.

" If when that time comes we are not able to stand by our exports alone, two things can happen—we must either reduce our imports of raw materials, which will cause unemployment, or reduce food imports, which must reduce our standard of living."

It was a grim picture and he called for stout hearts to face a steep hill.

" But think of the assets we still hold. We still have the skill of our workers, the great character of our people, the reputation of quality for our goods and we still have our ships sailing the Seven Seas.

" And we have in this country, a relationship between employers and workers which, although by no means perfect, is better than it is in any other country."

Mr. Kenneth H. Wilson, chairman of the Association, replied. He gave a brief history of the Association from the day it was founded in 1917 with 40 firms. Today the Association represented 250 firms with 70,000 employees.

He referred to their splendid relations with the trade union leaders " who are trying to pull along the same lines as we are to see that maximum production is reached. The men in the chemical industry have pulled their weight."

Australasian Aluminium Industry

Survey of Australian-Tasmanian Resources

LARGE scale development of Australian and Tasmanian bauxite resources and of the aluminium-producing industry in the latter country are foreshadowed by many of the findings of the Australian Aluminium Production Commission, set up in May, 1945, by the Australian and Tasmanian Governments, which has just issued its first report, covering the period from its inception to June 30, 1946.

Spurred by the knowledge that the known deposits of bauxite in Australia and Tasmania were unlikely to supply adequately the Continent's growing needs and that reserves as a whole, excepting those in Tasmania, were of a comparatively low grade, the Commission has carried out extensive prospecting and research generally, which have revealed substantial new deposits in many areas. Investigation in Tasmania before the Commission was formed established the existence 40 miles north-west of Hobart of 800,000 tons of bauxite, 600,000 tons of which were considered to be readily available and of suitable grade. (All the figures submitted were necessarily only approximations.) The discovery of 80,000 tons of ore south-east of Launceston, and indications of a further 120,000 tons indicate that total reserves in Tasmania should exceed 1,000,000 tons.

New Bauxite Deposits

Among the larger bauxite beds charted in Australia are: New South Wales, 18,250,000 tons of 38 per cent AL_2O_3 and 5 per cent SiO_2; Boolarra-Mirboo (75 miles from Melbourne), 735,000 tons of 51.3 per cent AL_2O_3 and 7.6 per cent SiO_2. In Queensland, where little is known of bauxite resources, the State Government has embarked upon geological surveys, and the Commission is hopeful that these may result in the location of higher grade ore than has previously been found in Australia.

The large lateritic bauxite resources of Western Australia are too high in silica to compete with the supplies available in Tasmania and Victoria. Investigations into the possibility of improving the grade by the removal of free silica, thus bringing it into the range of economic usage, are to be carried out.

Good Samples

Samples of Victorian and Tasmanian bauxite tested by the Dorr Company of New York, were reported to be sufficiently amenable to the Bayer test for economical exploitation. Much further investigation, the Commission recognises, must be carried out before a large-scale industry is planned, but there is already much evidence to suggest that the Continent may one day supply all its own requirements of aluminium.

Outstanding problems at the moment are to determine how the industry shall be located, having regard to the condition established in the agreement between the two countries that all the electrolytic reduction process shall be in Tasmania. Comparative costs of three systems—mining and chemical treatment on one site, chemical treatment at combined alumina and reduction plant, or mining, extraction and reduction at three separate sites—are now being studied.

Industry and the Crisis

F.B.I.'s Proposals : Strong Measures Advocated

PROPOSALS for dealing with the economic emergency are put forward by the Federation of British Industries in an interim statement issued this week.

Among the measures advocated are the setting of a higher coal "target"; re-examination of the policy on export of machinery; and speeding up of power station reconstruction. Grave anxiety is expressed concerning rail transport and emphasis is laid upon the dangers of inflation.

Strongly urging the importance of increased production and continuous close consultation with individual industries and with industry as a whole, the statement emphasises throughout the view that the present "unbalanced economic situation is critical in the extreme," but it concludes: ". . . . it is our firm belief that resolute action now, coupled with an all-out effort on the part of every individual in this country to pull his full weight, whatever his job, can and will make our future secure . . . . We believe that our future as an industrial nation depends on hard work, perseverence, initiative and enterprise. . . ."

Among the Federation's detailed proposals are the following:

BRIDGING THE GAP.—The Government should ensure that activities which are adjudged essential as short-term objectives shall be fully—and continuously—supplied with their needs in fuel and materials, while other activities or projects, whether productive or non-productive, are cut back.

COAL.—The target for coal should be increased to 220 million tons. The National Coal Board should be urged immediately to take all possible steps to improve coal washing facilities, and otherwise to improve the quality of coal delivered. Efforts should be made to import 10 million tons of coal, without reducing the quantities being shipped for the relief of Europe. The export of coal-cutting and other mining machinery needed for home use should be critically re-examined. The coal distribution plan already announced should be so operated that the extra amounts to be allocated, whether handled regionally or otherwise, are guaranteed amounts, and that the principle is observed that production considered to be most vital shall receive 100 per cent of its needs.

POWER SUPPLY.—Resources for building power stations and manufacturing their equipment should be mobilised, guaranteed their necessary supplies, and set a programme based upon a two-year construction interval. To meet the emergency, new designs for power station equipment should be deferred, and replicas of existing stations reproduced to save time. The export of power station equipment needed for home use should be critically re-examined. The importation of power station equipment from Germany should be examined. This form of emergency assistance should not be rejected merely because special power stations may be needed to accommodate the equipment; they should be constructed, and if necessary German specialist labour brought over to erect the plant. All other possibilities of importation should also be exhaustively surveyed. The arrangements for any necessary load shedding should be organised so that industrial undertakings may know the particular days on which their own turn for shedding may come.

MATERIALS.—A balance must be struck between supply and demand for steel. After increasing supply to the maximum possible, the method of securing this balance should be by reducing the amounts allocated to less essential parts of the programme. If the export and capital equipment targets cannot be reached in any other way, it may even be necessary to reduce the housing programme still further than is suggested in the White Paper.

INCREASE OF PRODUCTIVITY.—Parliament and industry should be enabled to concentrate upon the economic and production problems of to-day, and be relieved of the necessity to direct their thoughts and energies on to controversial issues that can be deferred. Incentive should be increased to all grades by a reduction in direct taxation. Consultation with industry should be maintained to keep a constant watch upon the export of capital plant. The conflict between the capital equipment and export targets should be resolved. In certain cases, notably rail transport, re-equipment at home should be given priority over export. The Government should collaborate with industry to ensure that the production of capital plant for the industries adjudged to be of greatest importance, should take precedence over that for other industries, which may in any case not be able to operate at full activity.

EXPORT.—There should be regular and continuing consultation with different industries in order to maintain a constant watch on their ability to continue selling fully manufactured goods, with an adjustment of policy when this may be found necessary.

CONTROLS.—No opportunity should be lost of getting rid of any one of the controls; the price mechanism which is the alternative should be allowed to act at the first possible moment.

American Chemical Notebook

From Our New York Correspondent

WHAT might have far-reaching effects on the supply of electric power by the United States Government to privately-owned industrial enterprises is embodied in a Bill introduced in the Senate, aiming to prohibit the Government from constructing or acquiring future hydro-electric plants "which have the generation of electric power and energy as their primary purposes." At present, chief sources for the development of hydro-electric power plants are located in the western regions of the States and should private enterprise, desirous of developing an aluminium industry on the Pacific coast, wish to apply to the Government for aid in construction of power plants, the Bill might effectively hamper them. The aluminium industry is today a chief user of hydro-electric power and the high installation costs of such plants must be taken into consideration in the development of further aluminium-producing centres. Under the proposed Bill, a new policy would be set up under which the Federal Power Commission would supervise the production, sale and distribution of electricity generated at Federally-owned hydro-electric plants except the Tennessee Valley Authority. Excess power produced at existing plants or those built in connection with flood control projects would be sold by the Federal Power Commission, with rural electrification co-operative being given first call. Any revenue derived would be turned over to the Federal Treasury. The sponsor of the Bill claims that it would save the Government the expense of building steam stand-by plants and of future construction of transmission and distributing lines.

* * *

The United States Navy has just released details of how it developed an alkyd resin-containing, fire-retardant paint, now expected to find important peacetime uses. Early in the war, the navy discovered that its painted bulkheads and decks were a liability; in a fire the layers of older type, oil base paint helped the spread. The burning paint also gave off acrid fumes to hamper fire fighters. Sometimes the paint would continue to burn after the source of heat had been controlled. In co-operation with the Office of Scientific Research and Development, research was undertaken to develop a paint that would not burn. An alkyd resin paint, made under U.S. Navy specifications, was found to be fire-retardant. Present Navy specifications for inside white paint call for 100 pounds of antimony oxide per hundred gallons and an alkyd resin base. While such paints will not stop a fire, the Navy reports, they will check the speed with which the flames spread. In many building fires, paint has carried flames through corridors and rooms, scattering fire-brands as it blisters and pops.

* * *

Mr. Donald M. White, secretary of the Aluminium Association, of which major producers, foundries and fabricators are members, reports that the output of aluminium products in the first two months of 1947 has continued to increase over last year. During January and February, the production of aluminium permanent mould castings ran more than 30 per cent ahead of the same period in 1946. He estimated, in addition, the output of aluminium castings of all types exceeded the 1946 rate. Sheet aluminium, used extensively in corrugated form for farm and industrial roofing, was shipped at a rate of more than 100 million pounds a year. More aluminium foil was rolled than during the same months last year and production of powder for pigment in aluminium paint also continued upward. One of the reasons why the demand for aluminium will continue to exceed new ingot production, Mr. White said, is the fact that the basic price for primary aluminium ingot has remained steadily at 15 cents a pound, while prices on virtually all other metals and materials have advanced.

* * *

Development of a chemical process to use such agricultural by-products as corn-cobs, cotton-seed hulls, and the hulls or bran of oats and rice in the making of nylon was disclosed by E. I. du Pont de Nemours and Co. at a meeting of the National Farm Chemurgic Council. The cobs, hulls, and other cellulosic materials are the sources of the chemical known as furfural. The new process turns the furfural into adiponitrile, a chemical important in making nylon. A new unit will be built at the Du Pont Electrochemicals Department's plant at Niagara Falls to produce the chemical.

* * *

A new, heavy, black and shiny mineral, found by Dr. Joseph Murdoch, of the University of California, in the Southern Pacific silica quarry near Neuvo, California, has been named "Nuevite." Though classed as a rare-earth mineral, it shows no traces of uranium under spectroscopic analysis. It is composed principally of yttrium, titanium and iron, with a small amount of tantalum. Its discoverer says that, because of its scarcity, there is no known use of the new mineral present.

Marine Chemicals in India*

How the Industry was Established and Developed

THE development of the chemical industry in India owes much to Mr. Kapilram H. Vakil, eminent chemical and industrial engineer who died last year. On the advice of Mr. Gandhi he gave up politics to devote himself to the country's industrial advancement; and he was instrumental in setting up new chemical manufacturing plants and in increasing output and efficiency of existing ones.

Very early, Mr. Vakil had realised the great importance and necessity of establishing key chemical industries in India and had put before him as his goal the establishment of a large alkali and heavy chemicals concern. As a first step he carried out a systematic survey of sites all over India and finally started the Okha (Mithapur) Salt Works in Baroda, which was the first of its kind to be run on modern lines in India. Following this lead numerous sea salt works sprang up in India.

Start of the Tata Works

In 1937, the Tatas accepted his scheme for establishing an alkali industry at Mithapur. The nation has to import ready-made plants from abroad, which are very often erected in India, with the help of foreign experts. But because of the war the company had to design, make and erect a considerable quantity of chemical plant equipment.

With the starting of the Tata Chemicals, Ltd., the Okha Salt Works were taken over by Tatas in 1939 for the salt required for the manufacture of soda ash and other heavy chemicals.

The present site was selected by Mr. Vakil, as the place has very low rainfall, high wind velocity and temperature and such natural contours of the land as would greatly help in drawing the brine into the salt works by gravity, which are very favourable factors for the manufacture of solar salt. The salt works are designed on modern lines and are protected by substantial dams against floods.

The layout was designed with the main object of collecting by gravity bitterns from all *kyars* for the recovery from them of valuable by-products. The salt works extend over an area of about 2000 acres. The present layout has a rated annual capacity of 125,000 tons which can be doubled when the new area is developed.

Sea water of from 3.5° to 4° Bé flows by gravity from the sea during tidal times into large marine lakes and then passes on to condensers and by gradual evaporation its density reaches 10° Bé. Up to this stage the first salt that is thrown out from the solution is calcium carbonate. After this separation of calcium carbonate, the liquid gets further concentrated by evaporation and some gypsum and the remaining calcium carbonate and sometimes also magnesium carbonate separate out at 12° Bé. When the concentration has reached 17° Bé, more calcium sulphate separates out as $CaSO_4.2H_2O$ (gypsum). The separated gypsum at first floats on the surface of the liquid as a thin grey film and gradually settles down to the bottom of the pan. Salt just begins to come out when the major portion of the gypsum ceases to separate. The separation of gypsum continues up to 25° Bé and is not entirely thrown out of the solution. About 84 per cent of the calcium sulphate present separates out in the crystallising pans.

At 24.5° – 25° Bé the salt begins to separate out, as the evaporation proceeds. As the concentration proceeds, more and more salt is thrown out of the solution till the brine reaches a density of 28.5° – 29° Bé. The concentration is not carried further, as the salt that separates out at this higher concentration is very impure and difficult to separate from the adhering bitterns.

When the salt is ready, the crop is lifted from the *kyars* and taken to a plant where it is mechanically washed and then stacked for drainage. When the salt is quite dry it is sent to the crushing mill for fine crushing.

Salt By-Products

As already mentioned, the salt works at Mithapur have been specially designed to collect the bittern left after the gathering of salt, so that all the important by-products are advantageously recovered. It is a general practice in all sea salt works in India, and most of the sea salt works abroad, to treat the bittern as a waste product. The research work for the recovery of several useful salts from this waste product was started by Mr. Vakil as early as 1917 and continued for over six years. As the result of his investigations, Mr. Vakil was successful in devising a satisfactory method for the recovery of all the by-products when the Okha Salt Works was established. After the taking over of this works by Tatas, the recovery of bromine from the bittern was also successfully carried out and a plant was put up to recover 10 cwt. of bromine per day from the bitterns. This

* From the *Journal of Scientific and Industrial Research*, India.

was the second bromine factory in the British Empire.

The discharged bittern from the salt *kyars* at 29° Bé, after further concentration to 35° Bé is used for the recovery of marine products.

To obtain Epsom salts the bittern is concentrated to a very high specific gravity and then suddenly chilled when crude Epsom separates out. The crude product is dissolved in hot water and when recrystallised gives Epsom salt of a high degree of purity. The final crystallisation is effected in a continuous crystalliser of modern design.

There is an average yield of 45 lb. bromine from 1000 gallons of bittern having a strength of 35° Bé.

Bittern discharged from the Epsom plant is heated to about 60°C. and is sent to the top of a granite tower. Steam is introduced at the bottom of the tower and chlorine is introduced part of the way up the tower. Chlorine reacts with the bromides forming free bromine. The chlorine and steam rise in the tower countercurrent to the descending bittern. The bromine vapour is condensed in stoneware coils. Part of the bromine is converted to potassium bromide of B.P. quality.

The potassium chloride manufacturing unit consists mainly of two sections. In the first section, the feed liquor which is the tail liquor from the Epsom and bromine plants is evaporated in a triple effect evaporator and then settled in stages for the separation of kierserne; and carnallite that is obtained in the previous cycle is split up for the recovery of potassium chloride which is then recrystallised.

Recovery of Potassium Chloride

The recovery of potassium chloride from carnallite ($MgCl_2$, KCl, $6H_2O$) by fractional crystallisation is complicated by the presence of other salts that are produced during the process. In general, the process consists of extracting the material with hot water, settling to remove insoluble salts and then cooling, when 80 per cent of the potassium chloride separates out. A portion of the mother liquor together with the wash water is used to extract the next batch of salts. The remaining mother liquor is again evaporated and, when this is cooled, practically all the remaining potassium separates as carnallite. This is added to the next batch of raw materials. The final liquor contains principally magnesium chloride. About 80 per cent of all the potassium salts produced is used as fertiliser. The remainder goes into the manufacture of a wide variety of miscellaneous chemicals.

The tail liquor from the potassium chloride plant contains a large amount of magnesium chloride, a considerable amount of colloidal organic matter, and a little sulphate. Such a liquid must be evaporated further in order to recover magnesium chloride ($MgCl_2.6H_2O$). During the evaporation, the temperature rises considerably, charring the organic matter and strongly darkening the magnesium chloride which separates on cooling. To destroy the organic impurities preliminary treatment with a strong oxidising agent is desirable. Magnesium chloride manufactured by Tata Chemicals is a snow-white fused product and is sent to the market packed in drums. There is also equipment available to market it in the form of flakes. Magnesium chloride makes a good filler for cotton and woollen goods and is a constituent of magnesia cements. Tata's magnesium chloride is one of the rare instances of a chemical manufactured in India which is being exported to the highly industrialised countries of Europe.

Treatment of Bittern

Part of the tail bittern from the bromine and other plants is stored in huge concrete reservoirs. This bittern is very rich in magnesium chloride and also contains some sulphate. When this is dosed with a calculated amount of calcium chloride liquor, the sulphate is precipitated and is removed in two thickeners. The treated bittern is then reacted with quicklime in a rotary slaker. By double decomposition magnesium hydroxide and calcium chloride are produced. The slurry is separated into the components and the magnesium hydroxide is thoroughly washed by counter-current decantation method in a series of six thickeners of huge proportions. The purified slurry is dosed with the requisite minerals in mixing tanks and then filtered through a rotary filter. This filtered sludge is fed into a rotary calciner fired by oil and raised to a high temperature Dead burnt magnesia or periclase comes out of the calciner continuously and is cooled in a rotary cooler and pulverised if necessary. The rated capacity of the plant is 20 tons of magnesia per 24 hours.

The electrolyser group consists of the following plants: (a) cell brine refinery, (b) cell house, (c) liquid chlorine, (d) bleaching powder, (e) hydrochloric acid and the following associated plants, (f) zinc chloride, (g) caustic evaporators and pots, (h) chemical lime kilns.

Concentrated sodium chloride is electrolysed and chlorine drawn away through earthenware pipes to be either liquefied or employed in making either bleaching powder or hydrochloric acid. Hydrogen is drawn away and is used in producing hydrochloric acid. Caustic soda solution is concentrated in a multiple effect evaporator and ultimately in caustic pots to a solid.

(*To be continued*)

German Shale Oil Production

Three Wurtemburg Processes

IN F.I.A.T. Final Report 447 " The Study of the Production of Shale Oil from Shale in Würtemburg " an account of the three processes in this area is given. It was of interest to the Germans during the war as a means of obtaning a quick supply of oil suitable as a substitute for certain diesel oils. Where petroleum is available it is not competitive to produce shale oil but it would, however, compete with the production of oil by the hydrogenation processes. Only two of the methods outlined in this report are worth noting in detail here.

The first method involved the construction of a parallelepiped formed from the shale which was 41 metres long, 11 metres wide and 3½ metres deep. The sides are inclined at an angle of 36°. Such a pile holds 1900 tons of material. Pipes are placed on the ground in a parallel direction to the width of the pile. These pipes are connected to a vacuum header for removal of oil and gas as it is formed and they can be used many times over. The pipes are slotted intermittently. A thin covering of dry peat is spread over the top of the parallelepiped and a vacuum of 30 to 45 mm. is maintained during the firing. The burning rate is controlled so that 25 cm. in height of the material are burnt per hour. A faster rate apparently causes loss of oil due to burning of the oil and tar products. If, however, a slower rate is maintained the fire would go out. The lighter fractions of benzene and toluene are lost to the air.

Interesting Applications

The Schorzingen plant is of greater interest to British industry as it might possibly have applications in the processing of low quality coal. The shale deposits at Schorzingen are 8 metres thick and outcrop from the hills. The beds are horizontal, which is a decided advantage for this purpose. Only the bottom part of the deposit containing a mean percentage of 5 to 6 per cent shale oils is distilled.

The bed is opened from a cut 60 metres wide and 120 metres long and tunnels are excavated on both sides of the bed. These tunnels are connected by 14 cross channels which are bored between them. From these 14 galleries horizontal drillings are made at an inclination of 45° to both walls. These drillings are loaded with an amatol type of explosive (consisting of 12 per cent T.N.T. and 88 per cent ammonium nitrate). The composition of this explosive is based on the maximum amount of shale that can be obtained in pieces about 50 cm. in diameter. Fines are a disadvantage. Thirty per cent of the shale as originally occurring in the bed is removed to provide the tunnels and galleries.

The underground pile is then sealed off and the galleries fitted with heated pipes and the rate of burning is controlled by the vacuum applied. Most of the oil condenses in the pipes with a considerable amount of water vapour. The latter condenses and is separated in a settling tank and the oil stored. The uncondensed gas passes to a vacuum header and a water condenser and again benzene and toluene are allowed to escape to atmosphere. About 30 per cent of available oil from a shale deposit is recovered. The whole quantity of shale in the bed takes six weeks to distil and the efficiency of the process depends on the size of shale and the rate of burning.

The third process, which is not worth while outlining, is based on a retort distillation but only shales of an oil content of 4 to 8 per cent are processed. Fifty per cent of the oil in such shales is recovered.

Czechoslovak Chemical Mission

A MISSION of representatives of the Czechoslovak Chemical Works (National Corporation) has recently visited England for discussions with the British chemical industry. The mission was headed by the Director-General of the Nationalised Chemical Industry, Dr. Martinek, and included representatives of the heavy chemicals, organic chemicals, synthetic resins and fibres sections of the industry and of the commercial department. In addition to the meetings with the Association of British Chemical Manufacturers and the British Chemical Plant Manufacturers' Association, the mission visited a number of British chemical works.

This is the first important visit of a Czechoslovak chemical delegation to a foreign country since the end of hostilities and had the character of a goodwill mission. The desire of the Czechoslovak industry to establish closer co-operation with the British and American chemical industries, has also been underlined by the appointment of a permanent consultant and adviser for these territories.

During their visit the Czechoslovak representatives outlined the two years' programme which had been drawn up for their industry. The programme lays emphasis on the production of synthetic fuels from domestic raw materials, benzene and its derivatives, phosphatic and nitrogenous fertilisers, sulphuric acid, soda ash, staplefibre and rayon.

ACETYLENE DEVELOPMENTS

New Applications in Germany

THE B.I.O.S. Final Report No. 266 (Item No. 22, 3s. net) is based on a translation of a paper outlining the work of Dr. J. W. Reppe, of the I.G. Farbenindustrie, on new technical applications of acetylene. These are described under four headings, *viz.*, vinylation, ethynilation, carbonylation and cyclic polymerisation. By vinylation is meant the addition reactions of acetylene, leading to a vinyl derivative. Addition can be brought about between acetylene and hydroxyl, sulphydryl, amino, amido and carboxylic acid groups, *e.g.*, $R-OH+HC\equiv CH \quad R-O-CH=CH_2$ (vinyl ether) or $R-SH+HC\equiv CH$ $R-S-CH=CH_2$ (vinyl-thioether), etc.

The polyvinyl ethers (trade name *Igevine*) were used as raw material for varnishes, as adhesives, as textile auxiliary media and impregnating media for the preservation of leather and as lattices for emulsions for making artificial leather. Ethynilation is a group of general reactions, discovered by Reppe in 1937, in which an ethinyl group is added, resulting in the formation of ethinyl compounds, alkinols or substituted propargyl amines. These reactions are brought about by catalysts of group IIb of the periodic system; in practice, copper acetylide has been found best.

Safety at High Pressures

The section devoted to carbonylation describes the products isolated from the reaction of acetylene and carbon monoxide in the presence of water, using metal carbonyls or metals (or their compounds) capable of carbonyl formation as catalyst. Section IV, on the cyclic polymerisation of acetylene, deals with the discovery, in 1940, of the polymerisation of acetylene into cyclo-octotetrane, by a new synthesis, which made the technical production of the latter substance possible.

As regards the technical application of the reactions described in this report, safe conditions for handling acetylene under pressure had first to be found. The report states that in this direction Reppe may be considered to have contributed as much as in devising the basic reaction. While acetylene under a pressure of 0.5 atmospheres was formerly considered dangerous and a pressure of over 1.5 atmospheres actually forbidden, it has now become possible to pump acetylene at 5 to 10 atmospheres and at 100° C. at several hundred cubic metres per hour with perfect safety.

Perhaps the most important application, states the report, is in the preparation of butadiene via butine diol, butane diol and tetrahydrofuran. For a large number of syntheses, Reppe has already done all the preliminary experimental work, so as to be able to produce them on the largest scale, but war conditions have prevented the development of further processes, notably of the manufacture of the acrylic esters from acetylene, carbon monoxide and alcohols, of alcohols from olefins and water, of acids, from olefins, carbon monoxide and water and of cyclo-octotetrenes from acetylene.

In addition to the new reactions described, Dr. Reppe has also been responsible for establishing, on a technical basis, processes already known, of which the following are mentioned in the report: inter conversion of alcohol and acetaldehyde, the production and applications of ethylene, and the production of butadiene. Reference is also made in the report to the preparation of ethylene chlorohydrine, required for the manufacture of hydroxy ethylaniline for the indigo synthesis. Ethylene chlorohydrin, prepared by the so-called "sump process" devised by Dr. Reppe, became a ready source of ethylene oxide, glycol and glycol ethers.

International Fuel Economy

FUEL economy will be the subject of a sectional meeting of the World Power Conference—the object of which is to consider how the sources of heat and power may be adjusted nationally and internationally—to be held at The Hague from September 2-9 this year. Among members of the British National Committee who will submit papers are Mr. J. A. Oriel (chief chemist, Shell Petroleum Co., Ltd.), and Major K. Gordon (joint managing director, I.C.I., Ltd., Billingham Division), whose subject jointly will be "Aviation Fuel Production"; Mr. T. C. Finlayson, technical director, Woodall-Duckham Co.) on "Fuel Economy in Coal Carbonisation"; Dr. J. D. Cockcroft (Director of Atomic Energy Research Establishment, Ministry of Supply) on "The Possibility of Industrial Applications of Atomic Energy"; and Professor W. A. Macfarlane (Director of Fuel Efficiency, Ministry of Fuel and Power) on "The Recovery of Industrial Low-Grade Heat." Thirty-three nations are members of the World Power Conference. The secretary of the British National Committee has offices at 201-2 Grand Buildings, Trafalgar Square, London, W.C.2 (telephone: Whitehall 3966).

Metallurgical Section

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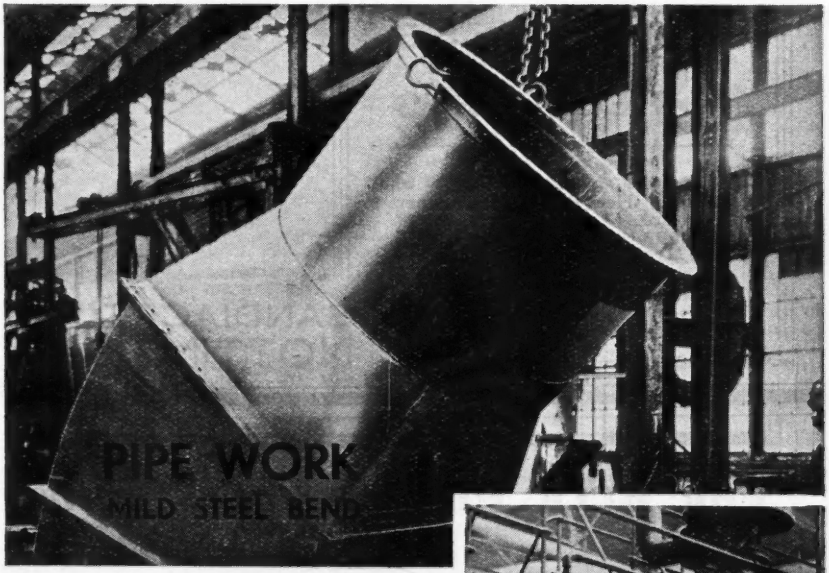

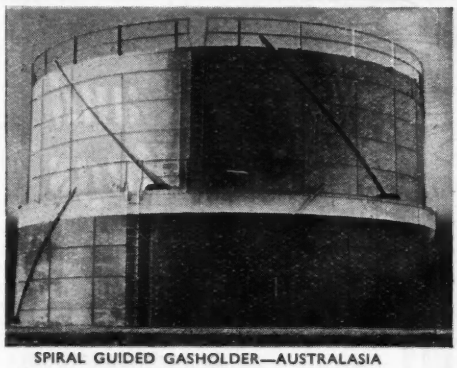

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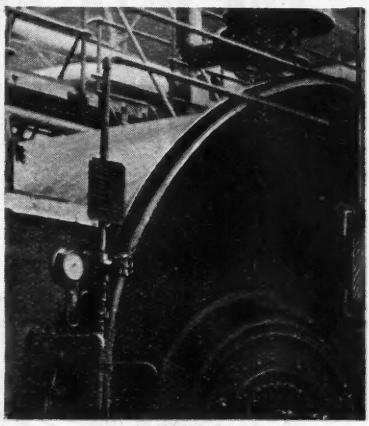

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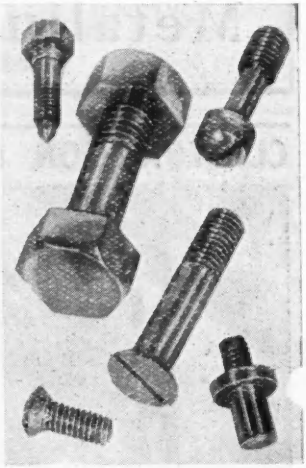

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Metallurgical Section

5 April, 1947

CHANGES IN STEEL BY FRICTION

Metallurgical Transformation

FOLLOWING considerable research and tests which simulated conditions encountered in industrial practice, Bernhard W. Sackmann, research engineer of the Carter Oil Company reports the occurrence of geometrical and metallurgical changes in steel surfaces under conditions of boundary lubrication. This is the first time such changes, determined in a series of laboratory tests, have been reported. The experiments consisted of a series of run-in tests made by the engineering division of the Chrysler Corporation and was fully reported to a recent meeting of the American Society of Mechanical Engineers held in New York. In all tests, changes in the geometry of the surfaces were noted and, under certain conditions, metallurgical changes could be observed. The material of the transformation was considerably harder than the martensitic steel of the test samples, and the etching characteristics of the transformed material were markedly different from those of the underlying steel. The metallurgical transformations, for initially smooth surfaces, had the form of ridgelike eruptions protruding over the surface of the test specimen by several microns. Heat-conductivity calculations made it possible to estimate the temperature reached during running-in.

Running In Tests

The running-in experiments, during which two hard steel (or cast iron) surfaces slide over each other, extended over a period of 16 hours. The friction force and the relative speed between the surfaces were kept constant at values of 3 lb. and 1000 f.p.m., respectively. The tests were performed on a friction test machine which consisted of a disc rotating at constant speed and the stationary flat test specimens, whose surface changes were to be investigated, were pressed against the disc. The disc was super-finished for each test, while the surface finish of the rider was varied. The flat test specimen, which was 1 in. long, ½ in. wide, and ⅛ in. thick, was held in such a way that it could tilt by a small angle in any direction. Thus the friction flat could conform to the shape of the oil wedge formed under it. From the speed and friction force between flat and disc, the rate of heat production was found to be 16 cal. per sec.

A pure mineral oil, Shell Talpa S. A. E. 20, was applied at the rate of 10 drops every 36 seconds. An organic pour-point depressor was the only addition agent of this oil. For most of the tests the temperature of the oil varied between 50° C. and 80° C. (120° F. and 175° F.). After running-in, the surface roughness of each test specimen and of each blank was measured with an Abbott profilometer and by means of taper-sectioning according to the method of Nelson. A tapered section, which is prepared by cutting the surface at a small angle, gives a magnified and distorted picture of any irregularities perpendicular to the plane of the surface. In the laboratory in which these tests were conducted, the taper-sectioning method has been successfully applied to three-dimensional problems. To prepare the oblique sections the run-in specimens were cleaned in ether and an alkaline cleaning solution. Then a copper flash was applied and the samples were nickel-plated. Following the plating the samples were ground on a surface grinder in such a way that the normals to the original and ground surfaces included a small angle. After grinding, the specimens were metallographically polished and etched with various reagents.

Geometrical Changes

The object of the first group of experiments was to imitate conditions prevailing in journal-bearing assemblies. Steel surfaces of 250-300 Brinell were run-in against Babbitted discs. Steel flats of carbon steel (S.A.E. 1040) and chromium steel (S.A.E. 52100) were run-in against super-finished Babbitt discs. In addition to the different steel specimens, flats of chilled cast iron (M.S. 891) were tested against Babbitt. The finish of the flat rider was varied from rough-ground surfaces with a profilometer reading of over 50 microin. to super-finished flats with a surface roughness of less than 1 microin.

In the first group of experiments the only changes that could be observed in the surfaces of the flats were of a purely geometrical nature. These geometrical changes, caused

by running-in, were more conspicuous for initially rough surfaces. The tapered sections showed that the grinding peaks of rough-ground specimens were flattened. This came as a surprise, inasmuch as the Babbit discs were considerably softer than the steel riders. The geometrical changes which were observed with steel and cast iron on Babbit were of the same nature as the ones which were found in later experiments when the same materials were run-in against much harder steel and cast-iron discs.

The aim of the second group of experiments was to imitate conditions which prevail in practice if both rubbing surfaces are made of hard materials. This series of tests, in which friction flats and discs were made of comparable hardness, can be divided into two groups. Chromium-steel flats (S.A.E. 52100) of different surface finishes were tested against discs of chilled iron (M.S. 891), and flats of chilled cast iron were run against chromium-steel discs. The hardness values of steel and cast iron (which were approximately the same) varied between 550 and 600 Brinell. The surface finish of the flats measured with the profilometer varied from 50 microin. for roughground to less than 1 microin. for superfinished flats. The discs were superfinished in all cases. Before the friction tests the profilometer readings of the discs varied between 3 and 6 microin. Weight determination of the flats before and after the test showed that the friction specimens never gained weight. This time the geometrical changes which were analogous to the ones observed when Babbit discs were used, were more conspicuous. As in the previous tests, initially smooth surfaces were roughened, while the peaks of rough-ground surfaces were abraded.

Figs. 1 and 2 show the tapered sections of a rough-ground chromium-steel flat before and after the friction test. For the two cases, the profilometer indicated a roughness reading of 46 and 37 microin. respectively.

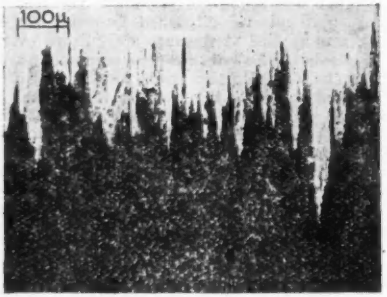

Fig. 1. Tapered section of rough-ground chromium-steel flat, before friction test.

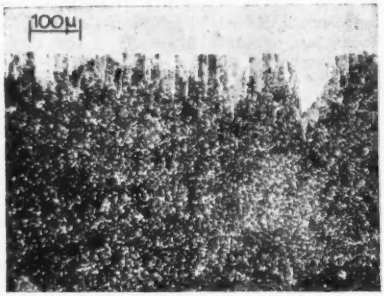

Fig. 2. Tapered section of same flat as Fig. 1, after friction test.

The grinding peaks were not worn off uniformly over the whole surface of the steel flats. The cross section of Fig. 2 represents a comparatively smooth part of the surface. Figs. 3 and 4 illustrate the wearing-in effects on a roughground cast-iron surface. Fig. 3 shows the appearance of the cast-iron surface before running-in; the profilometer gave a value of 55 microin. for the surface roughness of the flat. Fig. 4 shows different parts of the worn-in surface. After the friction experiment the profilometer indicated an average value of 40 microin. for the surface roughness of the flat. Fig. 4, which gives an exaggerated idea of the beneficial effect of wearing-in, shows to what extent a surface can be improved by running-in.

Additional running-in experiments were made on a bearing-test machine in which a steel shaft was run again a steel bearing. The results of these tests confirmed the conclusion of the experiments performed on the friction-test machine. Furthermore, the experiments of the bearing-test machine showed that the smoothing of the roughness peaks could be accelerated by suitable addition agents in the lubricant.

Metallurgical Changes

In many of the run-in chromium-steel flats and in some of the cast-iron specimens, metallurgical transformations were also observed. This fact became evident when various etching reagents were applied to the section. Forty per cent of the run-in chromium-steel flats showed the transformation. Fig. 5 shows the surface of a superfinished chromium-steel flat before the friction test; the profilometer indicated a surface roughness of 0.8 microin. After running-in, the greater part of the worn-in flat looked like the blank in Fig. 5. Another part of the surface which looked markedly different from the superfinished blank is shown in Fig. 6. It is evident from this figure that

fundamental changes took place in some parts of the friction flat. The ridgelike metallurgical transformations, depicted in Fig. 6, extended over more than one-half of the length of the friction specimen which was 1 in. long.

The greater part of the run-in flat had the appearance of a superfinished surface; the

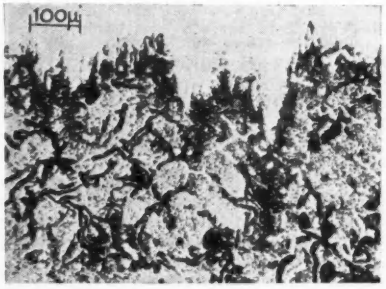

Fig. 3. Tapered section of rough-ground cast-iron surface, before friction test.

ridgeiike transformations, however, were very rough. The homogeneous appearance of the surface of the run-in flat, as shown by inspection of the tapered sections, was borne out by measurements of the surface roughness with the profilometer, the value of the surface roughness varying between 0.8 and 35 microin. As with the other run-in flats, observed transformations had nearly always the shape of ridges. The heights of the protrusions varied between 2 and 12 microins. and their widths covered a range from 100

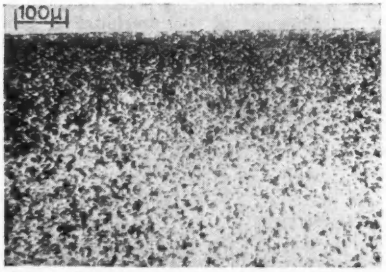

Fig. 5. Tapered section of super-finished chromium-steel flat, before friction test.

to more than 1000 microns; some of the longest ridges were more than 15 mm. long. In the oblique section of Fig. 6 four regions can be distinguished, i.e., nickel plate. transformed material, transition region, and bulk material of the steel.

The X-ray diffraction pattern of the transformed material was studied in a Phragmen camera. The transformed material of the specimen was 1.1 mm. wide, 15 mm. long, and extended to a depth of 0.04 mm. below the plane of the original superfinished surface.

Because of the small size and the shallowness of the transformed material, it was not found feasible to make macro-hardness tests

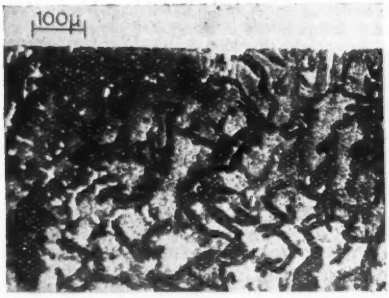

Fig. 4. Part of surface of same flat as Fig. 3, after friction test.

on a Vickers or a Rockwell machine. Tests were made with a microcharacter developed by Bierbaum. The material was scratched with a diamond under a load of 9 g., the width of the scratch is a measure of the hardness of the metal.

Scratch Hardness of Different Regions

	Scratch width, microns
Transformed material	2.5
Transition region	3-4
Bulk steel	5

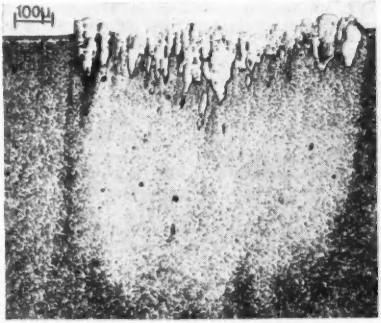

Fig. 6. Part of surface of same flat as Fig. 5, after friction test.

The Brinell hardness of the bulk material of the steel had a value of 580. An indication of the approximate value of the Brinell hardness of the transition region was given by an experiment from which one might well

conclude that the hardness of the transition region had a value of approximately 700 Brinell.

The effect of different heat-treatments on structure and hardness of the transformed material was studied. The sample which showed the transformation, was sealed in an evacuated pyrex tube. To prevent decarburisation of the steel during the heat-treatment, the flat was embedded in cast-iron chips. The sample was heat-treated at successive temperatures of 1000° F. (537° C.), 1100° F. (593° C.), and 1200° F. (650° C.), the microstructure of the material after the heat-treatment was studied. Comparative studies revealed that the grains of the transformed material grew as a consequence of the heat treatment. Subsequently, the sample which showed the largest region of transformed material was heat-treated at temperatures of 1150° F. (621° C.), and 1400° F. (760° C.). Before and after the heat treatment the run-in friction flat was etched with nitric acid and picric acid. The first heat-treatment at 1150° F. did not change the microhardness and the etching characteristics as revealed by the two etching reagents. After the second heat-treatment structural changes were visible in the transformed region as revealed by a nitric-acid etch.

In summarising the results of the investigations, Sackmann stated that the geometry of steel and cast-iron surfaces was changed during running-in tests. The peaks of initially rough surfaces were flattened, he said, and initially smooth surfaces were roughened. The geometrical changes were similar when the surfaces were run against a soft bearing material such as Babbit or against a material of comparable hardness such as cast iron and were more pronounced when two hard surfaces were run against each other. When the surfaces were run against a soft bearing material, only geometrical changes were observed. Conversely, when two hard surfaces were run against each other, metallurgical transformations were observed besides the purely geometrical changes. To the best of Sackmann's knowledge such transformations have not previously been reported.

During the running-in tests the local temperatures were high enough to cause decomposition of the lubricant. The nascent carbon set free in this process combined with the iron of the steel to form carbides. The volume increase connected with the carbide formation caused the load on the flat to shift to the transformation. As a consequence the region of the transformation was heated still more.

Precipitation Hardening—II*

By L. SANDERSON

WE must now consider what modifications of the properties of alloys occur when precipitation takes place. A state of maximum hardness of the alloy is not invariably coincident with modifications of the microstructure, *i.e.*, with perceptible precipitation. This may be because the first precipitations developing this maximum hardness are too minute to be visible by means of the microscope. An alternative possibility is that the state of maximum hardness in certain alloys may not be the result of precipitation, but of some previous process taking place before precipitation begins. The alloys in which this process may occur are the aluminium copper and duralumin alloys.

The trend of current metallurgical opinion is, however, towards the belief that assuming the right methods are adopted, even the first beginnings of precipitation can be detected by the microscope, and such beginnings have, in fact, been seen in the copper-beryllium, silver-copper, iron-molybdenium, aluminium-magnesium, and iron-tungsten alloys. In most instances microscopical technique is employed to establish the precise location of the precipitate. With the development of the precipitation process, it is probable that there will be a slow moving of the diffraction lines of the spectrum by reason of the declining lattice parameter of the solvent. In addition, it is possible to distinguish a precipitate by studying its lattice, assuming there is enough of it to produce a diffraction spectrum that can be recognised.

If the alloy is aged at a higher temperature, or over-aged, it will lose hardness, and this will be found to coincide with the disappearance of the streaks caused by the plates resulting from the transformation of the copper atoms into minute, two-dimensional layers, in the aluminium-copper and duralumin alloys. These streaks pass away slowly, and in their places a number of spots appear on the diffraction photograph, arising from the true precipitation of the particles of a new transitional tetragonal lattice. In other words, the segregation and the true precipitation of the above particles are superimposed.

These richer zones of atoms are a little

* The first part of this article appeared on 1, February 1947.

nearer to one another than those planes with a uniform copper atom concentration. The reason is that copper in solid solution results in a degree of shrinkage of the aluminium. These zones can be considered as nuclei of the tetragonal lattice. Similar lattices have been found in iron-carbon, aluminium-manganese-silicon, aluminium-zinc, and a number of magnesium alloys. Martensite is a characterstic lattice of this type.

When a metal forms solid solutions of solute atoms, its lattice parameter is increased or decreased continuously. Precipitation of the ordinary type would cause an uninterrupted and regular exhausion of the solid solution, and so an equally uninterrupted modification of the lattice parameter, which should start at the same time as precipitation.

Research has indicated that there is some basis for the theory that hardening takes place to a certain degree without precipitation, so that earlier theories of precipitation hardening have had to be changed. It appears evident, however, that lattice parameter measurements are too coarse as a means of perceiving the first stages of precipitation, because the precipitate is extremely localised, *e.g.*, at the crystal boundaries, and therefore does not sufficiently influence the lattice parameter of the basis solid solution to be capable of measurement. In fact, until exhaustion of the solid solution in the neighbourhood of the precipitate particles has proceeded far enough to produce a separate diffraction pattern, it is not possible to say that a measurable modification of the lattice parameter has taken place.

Electrical Conductivity

Turning now to the effect of precipitate formation on the electrical conductivity of an alloy, it should be remembered that if a specific quantity of an element exists in solid solution in a metallic alloy, the electrical conductivity should be reduced to an extent greater than the reduction would be if the same quantity of the element occurred in particle form. For this reason, in copper-aluminium alloys, the precipitation of $CuAl_2$ should cause an increase in electrical conductivity. When these aluminium-copper and duralumin alloys are aged at room temperature, or during the first stages of accelerated ageing at elevated temperatures, there is in fact, however, a *decline* in conductivity in about the inverse proportion to hardness. It is only when the higher temperatures of ageing are used that the normal increase in conductivity is found. The increase in ageing temperature from room temperature is, in fact, accompanied by a slight increase in conductivity. It is now believed, therefore, that ageing these alloys at a low temperature involve not precipitation, but some process occurring in advance of precipitation.

The next property to be considered is specific volume. When a phase is precipitated out of a solid solution, there will be either an expansion or a contraction according to the comparative specific volumes of the matrix and the precipitate. Research in connection with the aluminium-copper, aluminium-silicon, and aluminium-magnesium-silicon alloys has shown that an increase in volume occurs when precipitation is found, but is delayed until the state of maximum hardness has been passed. This increase in volume is the result of uninterrupted formation of $CuAl_2$ particles (at all events in the aluminium-copper alloys), owing to the swifter diffusion from the matrix. At normal temperature, however, there is an initial contraction, because the enriched planes of atoms are denser than the solid solution.

Magnetic Properties

In regard to magnetic properties, we need take into account only two, namely, the Curie temperature, and the magnetisation intensity. The Curie temperature corresponds to that at which there is a cessation of residual magnetism, and the material begins to show para-magnetic properties. This temperature is invariable for all magnetic alloys in a specific condition, but is modifiable by the concentration of the solid solution. Consequently, it should be continuously modified throughout the precipitation process. Such methods of studying precipitation are only applicable to the ferro-magnetic alloys where the solvent has a Curie temperature, such as iron. cobalt and nickel.

On the whole, the results obtained by research workers appear to correspond fairly closely to modifications of the lattice parameter measurements and changes in microstructure.

Magnetisation intensity can be employed as a means of recognising the precipitation of a ferro-magnetic from a paramagnetic material. Thus, for copper-iron alloys, ferro-magnetic iron should be precipitated as a result of an ageing treatment, and result in a higher intensity of magnetisation. This is actually found, however, only after straining, as a result of the quickening effect of ageing on straining. It is, therefore, reasonable to hold that in the copper iron alloys ordinary ageing does not give the equilibrium lattice of the alpha iron precipitate.

From the point of view of the industrial user of the lighter precipitation hardening alloys, it is variation in mechanical properties that is most important, and for this reason there has been an extensive employment of such variations as means of tracing

the development of precipitation. It is known that solid solutions are in their nature harder than pure metals, and that as the solute content increases, so the material hardens. In theory if a solid solution breaks up, therefore, the material should become softer, but in fact it does not. It hardens. It is not always true that this hardening, as earlier indicated, is caused by precipitation. It may result from strain developing in the interior of the material. For this reason it is impossible to regard modification of the mechanical properties of an alloy as anything other than a demonstration that ageing has caused some alteration in the internal structure of the material. The exact method by which this modification is obtained is not revealed by the mechanical property variations.

It is known that the higher the temperature to which the alloy is heated, the more quickly does a state of maximum hardness from precipitation occur. In relation to time, this attainment of maximum hardness at particular temperatures is ascertained from the formula $t = Ce^{m}/T$ where t is the period of tempering in hours, T the degree absolute, m is a constant and so is c. It is believed that a linear relation exists between tempering temperature and the highest possible hardness.

Effect of Ageing

Ageing appears to increase both ultimate tensile strength and yield point, producing curves comparable to those of variation in hardness. On the other hand, the ageing treatment generally varies inversely to hardness. Machinability is also improved if the alloys are completely aged, certainly more easy machining is possible than with the solution treated alloys. It is possible to cut the materials under more usual conditions, while it is generally possible to obtain a superior finish in proportion as the alloy is harder. Precipitation-hardenable alloys are highly sensitive to structural modifications in respect of damping capacity, which is appreciably higher in aged magnesium alloys than in aluminium alloys of kindred type. Damping capacity is at its lowest at a temperature somewhat below normal, but increases with rise or fall above or below this temperature. The reason for this is not known.

Precipitation hardened alloys have a higher fatigue strength as compared with annealed alloys of the same composition. understressing is advantageous to Y alloy, duralumin and magnesium-aluminium alloys. Alloying elements introduced into the alloys of aluminium type lower the resistance to corrosion. Manganese is the sole exception. ageing has definitely an adverse effect on duralumin, lautal, and alloys based on these, and it is noteworthy that it has the same bad effect on austenitic nickel chromium stainless steel of the 18-8 type.

Intercrystalline corrosion is experienced in the duralumin alloys in certain circumstances, and lowers the ductility of the material and its ultimate tensile strength. To give a measure of improvement in this respect, quenching duralumin at higher temperatures is advocated as long as the quenching medium is not plain boiling water, which lowers the corrosion resistance. The ideal quenching medium is a normal solution of sodium chloride with one per cent by weight of HCl. To overcome the poor corrosion resistance of duralumin and similar alloys, it is common practice to give them a cladding of pure aluminium on each side, the cladding representing about 5 per cent of the total sheet thickness. In carrying out solution treatment of thin sheets of these clad materials it is important to prevent the copper from penetrating too deeply into the aluminium coating. This certainly makes the sheet stronger mechanically, but the corrosion resistance is once more lowered. On no account must the temperature exceed 500°C.

Accelerated ageing, which involves heating the material to a temperature greater than 100°C., likewise lowers the resistance of duralumin to corrosion, and even worse is its effect on super-duralumin. There is a critical temperature range of 100° to 150°C. which markedly lessens the resistance of the material to saline solutions and seawater. In this respect the worst effect is experienced at 140°C. This appears to prove that raising the tempering temperature only lowers the corrosion resistance over a specific temperature range, and is not harmful outside this range, as far as normal treatment temperatures are concerned.

The anodising treatment has proved beneficial in minimising the corrosive attack of aluminium alloys, while if the sheets are also given a coating of lanoline, they will be still more resistant to corrosion.

(To be continued)

New Welds.—Some important recent additions to the wide range of operations made possible by modern electric welding equipment are described in detail and fully illustrated in the current quarterly issue of "The Welder," published by Murex Welding Processes, Ltd. The versatility of modern equipment and especially of the new electrodes now being produced for specific jobs is well illustrated in a series of articles describing in detail a variety of uncommon welding tasks successfully carried out on aircraft, ships, Bailey bridges and industrial plants.

Spectrographic Standards

WITH the increasing application of the spectrograph—the use of which was greatly developed in the war—in academic and industrial research and production control, there has arisen a need for highly purified metals and their compounds, for use as reference standards in qualitative spectrography, and in making standard mixtures containing known amounts of certain elements for use in quantitative spectrography. The corollary has been a greatly increased request for spectrographically standardised substances of increasingly higher states of purity and parallel developments in research, some results of which are reported by Messrs. Johnson, Matthey & Co., Ltd. The number of elements now available in this pure form has increased to 68, although some are still available only as oxides and salts. Most of the metals in common use can be obtained as spectrographic standards of exceptionally high standards of purity, including latterly copper now refined to include no oxygen and not more than 0.001 per cent of silver, lead and nickel. Extremely pure nickel and cobalt are also being produced.

Among the more interesting rare metals which are now available in reasonable quantities for spectrographic work and for research purposes are indium, gallium, thallium, germanium and rhenium. Extremely pure thorai, scandia, beryllia, zirconia, titania, vanadium pentoxide and ammonium perrhenate have also been prepared.

World Tin Shortage

INCREASED stringency in the supply position of tin metal is foreshadowed by the Ministry of Supply's announcement of a second interim allocation by the Combined Tin Committee for the first half of this year. Earlier estimates that this allocation would be increased by substantial additional receipts have not been borne out by events. The first interim allocations for January-June, 1947, totalled 10,915 tons (demands reached nearly 60,000 long tons) and supplies from all sources were only 17,700 tons. There remains a balance of only 6785 tons available for additional interim allocations. The Committee will review the position again in May when final allocations for this half year will be made, but warns that relatively large allocations made in 1946 were possible because there were available substantial stocks found in Malaya, Netherlands East Indies and Japan at the end of the war. No such "windfalls" are likely to be available now. The largest of the interim allocations now recommended are to the U.S.A., 9326 tons including an additional 5689 tons, France 2424 tons (plus 149 tons), India 1140 tons.

Metal Prices Up

A FURTHER sharp increase in non-ferrous metal prices, affecting copper, lead, tin, and aluminium, was announced this week. Proportionately the largest price increase is for lead, which rises £20 per ton to £90, equivalent to approximately 220 per cent of the rate ruling in January last year. Ministry of Supply price levels for lead have been: 1946, January, £39 per ton; April, £45; July, £55; 1947—January, £70; March 31, £90.

The new price for electrolytic copper, £137 per ton, represents an increase of £10. This, too, continues a trend which has added more than 200 per cent to the semi-manufactured material since January last year, when the Ministry price of copper was £62 per ton. The intermediate prices have been: 1946—January, £62 per ton; April, £72; July, £84; November, £ 98; 1947—January, £117; February, £127; March, £137.

The Ministry of Supply announced this week a rise in the price of virgin aluminium in ingot or notch bar from £72 15s. to £80 per ton delivered to consumers' works. The new price is for metal of purity 99 to 99.5 per cent and the scale of prices for metal of higher purity (99.6-99.99 per cent) is graduated from £88 to £180 per ton. The Ministry states that the increase in price enables the cost of aluminium purchased at home and abroad to be averaged out.

The fourth price rise, for tin, was notified by the Ministry on Monday. The new rate is £480 per ton—an increase of £56 10s.

German Steel Standards

Standards for steel and aluminium alloys are included in a 636-page microfilmed collection of German metallurgical research papers published by the Office of Technical Services, Department of Commerce, Washington. Among the subjects covered are: the creeping behaviour of aluminium alloys and heat resistent iron materials at high temperatures; standards and applications of various steels; endurance of non-welded chromium-molybdenum steel tubes under stress; experiments on the metal-arc welding of thin sheets of chromium-molybdenum steel; studies of butt-welded joints; the fatigue failure of metallic materials; and numerous lectures and discussions on various topics, one of which was a "ferrograph" designed to detect foreign materials in steel.

Thousand Mile Pipeline.—The Argentina Government has approved the expenditure of 90 million pesos on a pipe line about 1000 miles long to convey natural gas from the oil district of Comodoro Rivaldavia to Buenos Aires. Work will begin immediately as part of the national five-year plan.

Fuels and Chemicals

Experts' Symposium in Scotland

A SYMPOSIUM on coal, petroleum and their newer derivatives is being held at the University of St. Andrews from July 7-12, 1947. It is being arranged by the Scottish Sections of the Royal Institute of Chemistry and forms part of a general programme of scientific courses, conferences and symposia to be organised under the auspices of the Institute in the future.

The purpose of the symposium is to provide for industrial scientists and others a comprehensive survey of developments that have taken place in organic chemical industry. It is organised in three parts: the first, under the chairmanship of Mr. C. Augustus Carlow, will be concerned with coal and oil resources, and those who have agreed to participate are Dr. Kenneth Gordon, Professor W. M. Cumming, Mr. A. E. MacColl, Dr. D. T. A. Townend, Dr. C. C. Hall and Dr. Gustav Egloff (U.S.A.); the second part, under the chairmanship of Professor John Read, will deal with chemical synthesis and will include contributions by Dr. R. Hill, Mr. J. H. Brown, Dr. E. R. H. Jones and Dr. J. C. Swallow; in the third part, referring to physico-chemical problems of polymerisation, Professor W. F. K. Wynne-Jones will be chairman and arrangements are being made for lectures by Professor H. W. Melville, Professor Per-olof Kinnel (University of Upsala), and Professor W. T. Astbury.

U.S.A. Metallurgical Reports

Progress in metallurgical techniques is recorded in Bulletin 464 of the U.S.A. Bureau of Mines. This reviews the results of several years' intensive research in dressing and concentrating low-grade ores. Only gravity concentration by classification and tabling and magnetic concentration following reduction roasting are in use now on a commercial scale. Numerous photomicrographs are included. The pilot plant production of high-grade magnetite concentrates for use in sponge iron plants is the subject of a review, with much tabulated data.

13,000 More Miners

Several encouraging factors are seen in an analysis of the February figures of coal output and manpower issued by the Ministry of Fuel. In addition to the improvement in output of mined and opencast coal from 3,606,600 tons in February, 1946, to 3,777,300 tons, the number of workers was 1300 larger than the corresponding figure a year before.

Next Week's Events

TUESDAY, APRIL 8.

Society of Chemical Industry (Plastics Group). Manson House, 26 Portland Place, W.1, 2.30 p.m. Mr. A. A. Drummond, Mr. E. O. Phillips and Mr. G. R. Cornish: "Alkyd Resins Today."

WEDNESDAY, APRIL 9.

Society of Dyers and Colourists (London Section). Lecture Hall, Burlington House, Piccadilly, W.1, 6 p.m. Dr. G. L. Royer: "The Application of Microscopy to the Textile Field."

THURSDAY, APRIL 10.

Institution of Electronics. The Great Hall, Manchester College of Technology, 2.30 p.m. to 9 p.m. Annual General Meeting and 2nd Annual Exhibition.

Illuminating Engineering Society. Reynolds Hall, Manchester College of Technology, 6 p.m. Mr. W. J. Wellwood Ferguson: "Lighting in Coal Mines."

FRIDAY, APRIL 11.

Institute of Welding (South London Branch). Institution of Marine Engineers, E.C.3, 7 p.m. Mr. Railton: "Resistance Welding"; Mr. Clarke: "Gas Welding"; Mr. Mulder: "Arc Welding," Mr. Sillifant: "Argon-Arc Welding."

Textile Institute. Manchester, 1 p.m. C. Garratt: "The Bleaching and Subsequent Dyeing of Jute Fabrics."

Paper Makers' Association. Engineers' Club, Manchester, 7 p.m. Open discussion "From Press to Reel End."

Oil and Colour Chemists' Association. Engineers' Club, Albert Square, Manchester, 6.30 p.m. Annual General Meeting.

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Britain's Chief Planner

Ministers' Control

SIR EDWIN PLOWDEN, former Chief Executive (1944-45) of the Ministry of Aircraft Production, who was named last week as the Government's Chief Planning Officer for industrial reconstruction, is to withdraw from the several industrial undertakings with which he had been identified, notably C. Tennant, Sons and Co., Ltd., the chemical, iron and steel firm and general merchants, of which he was a director. He is also a director of the British Aluminium Company and of the British and South American Airways Corporation. At the age of 40, his war-time services had procured for him a K.B.E. in the last Birthday Honours list.

Sir Robert Sinclair, who will be Sir Edwin's principal collaborator as industrial consultant, undertakes a part-time appointment and will continue his connection with the Imperial Tobacco Company (Great Britain and Ireland) of which he is chairman, the British American Tobacco Company and the Finance Corporation for Industry. He is a former war chief of the Ministry of Production.

Announcing the appointments, the Prime Minister said the Chief Planning Officer would work directly under the Lord President and will have access to all Ministers concerned with production matters. He emphasised that all decisions of planning policy would be made by the Cabinet and not by the Chief Planning Officer. Responsibility for these decisions, he said, must rest wholly with Ministers.

Royal Society of Chemistry

Bristol Section

THE Bristol and South-Western Counties Section of the Royal Society of Chemistry held their 26th annual meeting in the Chemistry Lecture Theatre of Bristol University on March 20.

Mr. B. W. E. Minifie was elected hon secretary of the section in place of the retiring secretary, Mr. F. P. Hornby, who has held the post for the past 11 years. The chairman, Dr. T. Malkin, moved that Mr. Hornby be accorded "a generous vote of thanks."

Messrs. H. S. Howes and H. J. Millavoys were re-elected hon. auditors. Mr. W. H. Simmons retired from the committee in rotation and a further vacancy was caused by the death of Mr. F. E. Needs. These vacancies were filled by Messrs. W. Baker and S. J. Greig.

The meeting was followed by an address by Dr. E. B. Maxted on "Some Recent Advances in Catalysis."

Increases in Prices of Refined Oil

Following the increase in prices of unrefined oils announced last week, the Minister of Food now announces that the prices of refined oils and imported edible animal fats allocated to primary wholesalers and large trade users during the eight-week period March 30 to May 24, 1947, will be advanced by £28 per ton to the following prices per ton:

Coconut oil: (refined deodorised) £112 naked ex works; (refined hardened deodorised) £116 naked ex works.

Palm kernel oil: (refined deodorised) £112 naked ex works; (refined hardened deodorised) £116 naked ex works.

Cottonseed oil, groundnut oil, sunflower oil, sesame/benniseed oil, maize oil, soya bean oil, groundnut oil: (refined deodorised): £114 naked ex works; (refined hardened deodorised to 40°) £118 naked ex works; (deodorised to 50/52°) £119 naked ex works.

Palm oil: (refined deodorised) £111 naked ex works; (refined hardened deodorised) £114 naked ex works.

Whale oil: (refined hardened deodorised to 42°) £117 naked ex works; (deodorised to 46/48°) £118 naked ex works.

Stearine Empire: £118 c.i.f. in softwood barrels or tierces; if in hardwood barrels or tierces £1 5s. per ton extra.

Surplus Acid

Chlorosulphonic acid for the production in war of smoke screens is held in substantial quantities by the Ministry of Supply and is the source of useful additions to the commercial stocks of sulphuric and hydrochloric acids. Arrangements have been made for the smoke screen material to be broken down at the Royal Ordnance Factories. A good deal of the resultant hydrochloric acid, of average strength 33 per cent containing 5 per cent H_2SO_4, is not yet accounted for by contracts with the Directorate of Disposals of the Ministry of Supply.

Wing Commander L. R. Batten, O.B.E., B.Sc., LL.B., Barrister at Law, the newly-appointed general secretary of the Chemical Society. He succeeds Dr. D. C. Martin, who has been appointed assistant secretary to the Royal Society.

I.C.I. Paying 2 Per Cent. Bonus

THE directors of Imperial Chemical Industries, Ltd., recommend a final dividend of 5 per cent actual which, with the interim dividend of 3 per cent, makes 8 per cent for 1946 (as for 1945), together with a bonus of 2 per cent actual.

The 1946 income of the company, shown below, is presented on a new basis in that there has been provided the total amount of income tax to be borne by the company and not only, as in past years, the income tax to be borne on the company's undistributed profits. The income stated is, therefore, " net " of income tax and the dividends provided are stated on the same " net " basis. The 1945 comparative figure of income has been adjusted accordingly.

Net income for the year 1946, after providing all taxation on the profits of the year and £3,000,000 (as against £2,500,000 for 1945) for the central obsolescence and depreciation provision, amounts to £7,171,109, compared with £4,770,062 brought to credit from past over-provisions for taxation (as against £1,100,000 for 1945).

The total amount available for 1946, including £1,337,280 brought forward from 1945, is £8,508,389. Of this balance the directors have made a further special central provision for obsolescence and depreciation of £1,500,000 (the same as for 1945). Provision for the dividend (net) on the preference stock amounts to £926,994, and for the interim and final dividends and bonus (net) on the ordinary stock to £2,775,580, leaving £3,305,815 to be carried forward to 1947.

The twentieth ordinary general meeting of the company will be held at Wigmore Hall, 36 Wigmore Street, London, W.1, on May 8.

Still Short of Fuel

North-West factories and workshops, operating on reduced fuel allocations, have introduced drastic economies in their efforts to maintain production. The Dunlop Rubber Co., Ltd., states that coal supplies are very tight—less than they were before the crisis. The company has instituted stringent economies wherever possible and production is being maintained, and, in some cases increased, but how long this can continue is uncertain. An Official of Pilkington Bros., St. Helens, said : " Our expansion programme, launched before the fuel crisis, is still going ahead. Whether it will continue depends on the future supply of raw materials and fuel. At the moment we are living from hand to mouth, but production is being maintained."

Record Year for Monsanto Chemicals

AT the thirteenth annual general meeting of Monsanto Chemicals, Ltd., Dr. L. F. Nickell, chairman, reviewing the company's activities during the year, said many difficulties in the matter of shortages of fuel and raw materials, supplies and equipment had been encountered. Particularly distressing had been the difficulties with packages and coal. The chemical business was one in which packages were especially important, and the range of packages required was a wide one. A number of makeshifts had had to be used, and these had not always succeeded in getting goods to the customers in proper condition. The present situation was extremely difficult, and was not becoming easier. Like all industry, the activities of the company had been adversely affected by the fuel shortage.

" This is a serious basic problem that faces not only this company but the entire country. It is inconceivable that this problem of adequate production of coal cannot be solved. It must be. The only alternative is chaos. But time is the essence; not only must it be solved, but in the shortest possible time," said Dr. Nickell.

In spite of all these handicaps, the year had been a record one, he added.

At the last annual meeting reference was made to short-term and long-term plans. In spite of the difficulties, marked progress was made with the short-term plan, said Dr. Nickell. Much of this plan remained to be done, but the progress already made was the factor chiefly responsible for the satisfactory increase (35.5 per cent) in the company's business, and an important factor in the increase (80 per cent) in trading profit. It was gratifying to note that with this increase in business, 33 per cent was direct export business, and a further important percentage of domestic sales was known to have been exported in the form of customers' products. With respect to the long-term plan, long delivery periods for equipment and the general shortages of building materials, were proving a great handicap. But plans had been completed, and construction was on the point of starting.

After depreciation of £69,343, and provision for taxation of £572,859, the accounts for the year ended December 31, 1946, show a profit of £237,878 (£94,337); surplus and reserves of £1,503,284 (£1,046,034); current liabilities and provisions of £846,662 (£811,168); and current assets of £1,765,368 (£1,490,101). A tax-free final dividend of £70,000 on the ordinary shares was recommended.

The retiring directors, Dr. W. H. Garrett and Mr. Alfred D. Daysh, were re-elected.

A CHEMIST'S BOOKSHELF

Textbook of Organic Chemistry. Julius Schmidt and H. Gordon Rule. Revised by Neil Campbell. Fifth Edition. Pp. 939. Gurney & Jackson. 32s.

The appearance of a new edition of this well-known standard work is ample evidence of its popularity. This popularity has been well earned by previous editions largely due to the clear way in which the fundamental facts of organic chemistry were presented. In this new edition Dr. Campbell maintains this feature.

Since the publication of the last edition (1943) much of interest in the realm of organic chemistry has occurred. Many of these advances have been of an applied nature and therefore cannot be dealt with fully in a book of this nature, but where appropriate such new substances as DDT, penicillin and paludrine have been discussed. On the more academic side several natural products have been synthesised, including biotin and quinine, while the knowledge of the chemistry of aliphatic hydrocarbons has greatly increased and paraffins can now be nitrated.

The author of a book of this nature is confronted by the acute problem of how to present a complete survey of the subject within a limited number of pages and yet to keep up to date important topics. The selection of new material should be guided mainly by consideration of the type of reader for whom the book is designed; in this case those desiring information on the basic principles of organic chemistry. It, therefore, seems a pity that although the above topics have been included some of more fundamental importance have been omitted. Shortly before the war several books were published dealing with the acetylenic hydrocarbons and more recently many new and important uses of acetylene itself have been announced. It is thus disappointing to find that the alkynes are allotted only a couple of pages as they have been in all text books for the last 25 years.

One of the characteristics of Schmidt when it was published originally was that the various reagents for different reactions were specified in place of the ambiguous terms "oxidation" or "reduction," etc. It would be as well to maintain this good reputation in future editions by giving some information of newer reagents such as periodic acid, lead tetra-acetate and organo lithium compounds.

Much of the present-day research work is devoted to a fuller understanding of the mechanisms of reaction and so it is pleasing to find that there are sections on resonance and the electronic theory of valency, but it is to be questioned whether it is wise for these two closely related subjects to be in widely different parts of the book. Considering the general level of the book it would seem wiser to group these topics together and illustrate their use by referring to the elucidation of the structure of benzene, instead of dealing separately with this topic.

Great progress has been made recently in connection with the chemistry of vitamins, hormones and enzymes and much of the chapters dealing with these topics have been rewritten to accommodate the new material. Two chapters of topical interest are those dealing with chemotherapy, wherein the search for quinine substitutes and the discovery of penicillin are discussed, and that on new plastic materials, including nylon and organo silicon polymers.

Many of the topics are necessarily treated briefly, but this is no drawback since in all cases of particular interest either the original literature is cited or else some comprehensive review article which is easily accessible.

In revising this new edition Dr. Campbell is to be congratulated in producing a volume which is both useful as a textbook and as a work of reference which well deserves a position on every chemist's bookshelf.

Society of Public Analysts

CHEMISTRY owes to quantitative analysis its elevation to the rank of a science." That pronouncement by Professor Fresenius, of Weisbaden, formerly an honorary member of the Society of Public Analysts, was recalled by the retiring president, Dr. G. W. Monier-Williams, addressing the 73rd annual meeting of the society and drawing attention to the neglect of systematic teaching of chemical analysis at the universities. Mr. L. Eynon, B.Sc., F.R.I.C., who has served the society as hon. secretary for some 11 years, was elected this year's president, and Mr. K. A. Williams as hon. secretary.

Personal

MR. GLANVILL BENN, chairman of Benn Brothers, Ltd. (chief proprietors of THE CHEMICAL AGE) left by air for the United States on Tuesday. He has gone on a business trip which will take him across the U.S.A. and into British Columbia. He expects to be away about six weeks.

SIR PHILIP WARTER is relinquishing his post as Board of Trade Adviser on Trading Estates, which he has held since January, owing to the demands of his own business.

SIR FRANCIS JOSEPH, Bart., K.B.E., D.L., is visiting Spain to inspect the mines and property there of Rio Tinto Co., Ltd., of which he is a director.

SIR JOHN LENNARD-JONES is to succeed Sir Frank Smith, who has retired from the chairmanship of the Ministry of Supply Advisory Council on Scientific Research and Technical Development. Sir John joined

Sir John Lennard-Jones

the Ministry staff in 1942 as Chief Superintendent of Armament Research and later became Chief Scientific Officer. He resumed his university duties as Professor of Theoretical Chemistry at Cambridge last August. He is 52. Sir Frank, who is 67, is now Director of Research with the Anglo-Iranian Oil Company and chairman of the Radio Research Board. He had been chairman of the council almost since its inception early in the war. He will maintain certain connections with Government committees.

MR. MALCOLM DUNBAR, after 40 years with L. Oertling, Ltd., including 28 years as managing director, is retiring under the age limit. As a member by marriage of the family, he provides a direct link with the original L. Oertling, who set up as a balance manufacturer in London about 1847. Mr. Dunbar's direction of the firm has coincided with major developments in balance technology, including the inter-war period of acute German competition. He is a member of the Royal Institution and of the Society of Chemical Industry and a former president of the Rotary Club of London.

Dr. G. M. Bennett

DR. G. M. BENNETT, who, as announced, has been elected a Fellow of the Royal Society. An unfortunate error led to a photograph of Mr. J. G. Bennett appearing last week under Dr. Bennett's name.

The Council of the Textile Institute has nominated SIR E. RAYMOND STREAT, C.B.E., for re-election as president of the Institute at the annual meeting at Leicester on Wednesday, April 23. MESSRS. H. G. GREG (Manchester) and F. KENDALL (Leeds), and DR. J. C. WITHERS (Manchester) are nominated for re-election as vice-presidents.

DR. M. P. APPLEBEY, Research Director, Billingham Division; MR. A. E. BEARDER, Delegate Director, Imperial Chemical (Pharmaceuticals), Ltd.; MR. H. D. BUTCHART, in charge of I.C.I. Government contract work; MR. J. L. DEUCHAR, chairman, Salt Division; and MR. J. R. MURRAY, a director, Lime Division, are all retiring from the service of I.C.I., Ltd., according to the March issue of *I.C.I. Magazine*.

DR. CHAS. A. COULSON, who has been appointed to the newly-established chair in theoretical physics at King's College, London University, has carried out research in connection with the Department of Scientific and Industrial Research and since 1945 had been I.C.I. Research Fellow in Chemistry at the Physical Chemistry Laboratory, Oxford.

Obituary

DR. WALTER RAMSDEN, M.A., D.M., Emeritus Johnston Professor of Biochemistry at Liverpool University and Senior Fellow of Pembroke College, Oxford, died at his home at Oxford last week, aged 78.

PROFESSOR V. M. GOLDSCHMIDT died in Oslo on March 20, aged 59. He was internationally known for his work on geo-chemistry and crystal chemistry. He was a foreign member of the Royal Society.

Home News Items

Explosion.—A building containing chemical powders for making fireworks was destroyed following an explosion at the premises of Messrs. Wilders, fireworks manufacturers, at Greet on March 22.

Aluminium Production.—Aluminium production in the United Kingdom during January amounted to 8100 long tons, including virgin (all unwrought forms) at 2708 long tons and secondary ingot (excluding recovery at Government depôts from crashed aircraft) at 5392 long tons.

Gas Identification Officers.—A reunion of Gas Identification Officers of the London Region will be held on April 24. Any officer—including officers from other regions now living in or near London—who has not yet received an invitation and wishes to attend should write to Mr. T. McLachlan, 4 Hanway Place, London, W.1.

Oil for Steel Smelting.—One of six furnaces at the Linwood works, Paisley, of Wm. Beardmore and Co., Ltd., is now operating as the first oil-fired open-hearth steel smelting furnace in Scotland. Other furnaces are to be converted to oil burning, estimated saving of coal being 750 tons weekly.

Steel in Atomic Research.—One thousand tons of plates of high permeability steel are being rolled by Colvilles, Ltd., for a cyclotron installation for Birmingham University, the firm's chief metallurgist, Mr. William Barr, intimated when addressing West of Scotland Association of Foremen Engineers. The cyclotron might be regarded as the " machine tool of the modern scientist " and was used for splitting the atom, he said. The largest model of this machine, located in America, weighed 4000 tons; and it was interesting to note this particular application of steel in the entirely new field of nuclear physics, Mr. Barr added.

U.K. Tin Position.—There was an improvement in stocks of tin metal in the United Kingdom at the end of February by comparison with the beginning of the month. On February 1, Ministry of Supply stocks totalled 7974 long tons, production during the month amounted to 2872 long tons, deliveries were 2334 long tons (2075 to U.K. consumers; 259 for export), leaving a total of 8512 long tons at February 28. Consumers 'stocks at the beginning of the month stood at 3910 long tons, which were augmented by deliveries as stated, 1888 long tons were consumed, leaving stocks calculated at 4097 long tons (reported at 3863) at the close of the month. Stocks of tin ore fell from 7731 to 6456 tons between February 1 and 28.

Changed Telephone No.—The telephone number of James Kent, Ltd., Manor Street, Fenton, Stoke-on-Trent, has been changed to 48835-6-7 (3 lines).

Gas From £80 Oil Plant.—A process whereby gas oil is used instead of coal has been introduced at Richmond (Yorks.) Gas Works at a reported cost of £80 and estimated to save 260 tons of coal per year. The plant will use 60 tons of oil yearly.

Mercury in Agriculture.—Use of dry mercurial dressing is being recommended for seed grains this season and particularly for oats and wheat. Information indicates that these seeds are heavily infected and that dry mercurial dressing will largely control the diseases, and particularly fusarium.

Gas Expansion.—As a first stage in its post-war development programme, the United Kingdom Gas Corporation is to build for its subsidiary, Louth Gas Light Gas Company, at Louth, Lincolnshire, a completely new gasworks, carbonising plant and coke- and coal-handling equipment, at a cost of some £52,000.

Serious Blaze Averted.—Fire at Courtaulds Chemical Works, Trafford Park, Manchester, recently caused slight damage to a three-storey building in which hundreds of tons of sulphur and charcoal were stored. Another Trafford Park fire was at Manchester Oil Refinery, where a bottle of benzole broke and contacted a lighted bunsen burner in a laboratory. Some apparatus was destroyed.

More At Work.—There were 83,000 more people in employment in January this year (18,126,000, of which 5592 were women) than in December, 1946. Of the 17,679,000 employed in general industries 2,557,000 were concerned with metals and chemicals for the home market (35,000 more than in December) and 941,000 with export metals and chemicals.

Metal Physics.—A summer school in metal physics is to be held, by courtesy of Prof. Sir Lawrence Bragg, at the Cavendish Laboratory, Cambridge, from September 1 to 12. Its object will be to provide an introduction to the application of physical methods to the examination and utilisation of metals, embracing X-ray methods and study of physical and mechanical properties. Completed application forms must be sent not later than June 7 to Mr. G. F. Hickson, Secretary of the Board of Extra-mural Studies, Stuart House, Cambridge, from whom all particulars are available

Overseas News Items

Synthetic Rubber in U.S.—A resolution for the maintenance of the synthetic rubber industry has been passed by the House of Representatives.

Phosphate Rock Deficits.—It has been estimated that the United States will be short of phosphate rock supplies this year by two million tons, quantities available amounting to 14,870,000 tons.

Insecticide Orders.—The Argentine Ministry of Agriculture has been authorised to spend up to 900,000 pesos on the purchase of insecticide in the United Kingdom, to be delivered this year for future campaigns against locusts.

Copra and Coconut Oil Imports.—U.K. imports of copra and coconut oil from Malaya reached their highest level in November last, when 1650 tons of copra (£30 5s. ton f.o.b.) and 2380 tons of coconut oil (£56 ton, f.o.b.) were received.

Indian Soda-ash.—Soda-ash production in India, once negligible, is now estimated to be adequate for 70 per cent of her needs, based on which rapid expansion of the Indian glass industry is being promoted by the Central Glass and Ceramic Research Institute, Calcutta.

Machinery for Chile.—The Chilean Government has authorised machinery for new industries and for modernising or expanding existing factories to be imported free of Customs duty up to December 31, 1947, provided such undertakings are considered necessary or useful to the national economy.

Swiss Imports from Argentina.—Under a recent trade agreement between the two countries, the Argentine Government will make available to Switzerland, among other commodities, 45,000 tons of oil cakes, 5000 tons of edible oil, 9000 tons of linseed oil, 2000 tons of quebracho extract.

Exchange of Chemicals.—The terms of a recently concluded trade agreement between Austria and Belgium/Luxemburg provide for the delivery of 300 metric tons of Austrian graphite, while Belgium/Luxemburg will supply, *inter alia*, 20,000 tons of superphosphate, Thomas-slag, sulphuric acid, and dyestuffs.

African Copper for U.S.—The copper mining property, formerly owned by the Otavi Minen-und Eisenbahngesellschaft at Tsumeb, South West Africa, which was closed in 1940, has been purchased by U.S. interests from the Custodian of Enemy Property for approximately £1,000,000. It is expected that the mine will soon be reopened.

New Zealand Titanium Ores.—Vast reserves of titano-magnetite—some 22 million tons it is estimated—are contained in the beach sands of Wanganui, near Wellington, New Zealand. The mineral present in the sand represents 20 per cent.

New Source of Petrol.—Rich deposits of petroleum have been discovered in Djezuneh, Syria, and in the district of Terbal, Lebanon. Drilling has already been started by the Syrian Petroleum Company.

Persian Development. — The Persian Government has engaged a private American company, qualified in engineering and construction, to study the country and make recommendations for development.

Malayan Rubber.—Restrictions on new planting and re-planting of rubber in eight states of the Malayan Union have been lifted, according to a Government notice. This follows representations by the United Planting Association of Malaya.

Chemical Exports Trebled.—Shipments of Swiss industrial chemicals were valued at 6.8 million francs in January, 1947, as compared with 2.3 million francs in January, 1946. In the same period, exports of dyestuffs rose from about 13 to some 18 million francs, while exports of pharmaceutical goods soared from 7.9 to 17.4 million francs.

Output of Dyes.—Output of dyes in the U.S. zone of Germany, amounted to 118 tons in the third quarter of last year, compared with 133 and 87 tons in the two previous quarters. Soda ash output amounted to 4837 tons in the third quarter of 1946 (against 2733 tons in the first quarter) and exceeded the 1938 average by 1637 tons.

U.S. Streptomycin Production.—According to the U.S. Civilian Production Administration, production of streptomycin totalled in the first ten months of last year 1,132,132 grammes, output having risen from over 26,000 grammes in March to just over 200,000 grammes in December, 1946. Small quantities have been sent abroad, beginning in October last. The present price is $6.00 per gramme, as compared with $20.00 in March, 1946.

Kenya Customs Duties.—Several industrial chemicals figure on the free list in the new Customs Tariff Ordinance, 1946, recently issued in Kenya. Included are silicate of soda, caustic soda and caustic potash, litharge, salt-petre, sulphur and phosphoric acid paste and similar sugar clarifying agents, copper sulphate, arsenates of soda and lead, calcium carbide, acetic acid and other acids used for disinfection or coagulation of fluid latex.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

VINYL PRODUCTS, LTD., Carshalton, chemical manufacturers. (M., 5/4/47.) February 24, first debenture, to Westminster Bank Ltd., securing all moneys due or to become due to the Bank; general charge (subject to etc.). *£6000. February 7, 1947.

Company News

A dividend of 3½ per cent (same), representing the total dividend for the year (same), is declared by **Amalgamated Metal Corporation, Ltd.**, whose net profit is provisionally put at £210,449 (£211,013).

A third interim dividend of 19 per cent (17), making a total to date for the year ending March 31, 1947, of 36 per cent (32 plus bonus 4), has been declared by the **Beecham Group**. Though the directors expect net distributable profits to be much in excess of the previous year's, consideration of payment of a final dividend is deferred until accounts are ready in July.

After a lapse of 24 years, **Rhodesia Broken Hill Development Co.** resumes dividend payments with an interim distribution of 15 per cent for the year ended December 31, 1946. The last payment was 10 per cent for 1922. Preliminary figures for the year show a net profit, before providing for taxation, of approximately £617,000 (£367,000).

" Due mainly to shortages of raw materials and fuel, it has been impossible to meet fully the heavy demand for many materials we manufacture and distribute. We have been faced on the one hand with reduced supplies of standard products and on the other with enforced use of temporary substitutes." These are comments by the chairman of **Anchor Chemical Co., Ltd.**, Mr. T. H. Hewlett, in a statement presented at the annual meeting. In spite of " one of the most difficult " periods in the company's history, he said, the year's trading had proved very satisfactory. [*See* THE CHEMICAL AGE, March 8, p. 301.]

Reference to the difficulties of " endeavouring to cope with an increasing volume of orders and with no improvement in the raw material position " was referred to by the chairman of **International Paint and Compositions Co., Ltd.**, Mr. C. R. Petrie, at the annual meeting. Only 3 per cent of the total allocation of oil to the paint industry was allowed to be used in paints for export, with the result that we were losing our export trade to countries more favourably placed, he also pointed out. The company's net profit for 1946 was £330,588 (£308,578), on which a final dividend of 22 per cent, making a total for the year of 28 per cent, is being paid.

By the end of 1946, mining and smelting operations of **International Nickel of Canada** had been stepped up to a rate of production approximately 75 per cent of the maximum war-time figure. Ore mined in the year was 7,736,334 short tons, compared with an average annual tonnage of 11,453,154 in the three preceding years. Proven ore reserves at the end of 1946 stood at 217,142,000 short tons, containing 6,861,000 tons of nickel-copper, compared with 217,373,000 short tons containing 6,866,000 tons of nickel-copper at the end of 1945 and 212,368,000 short tons containing 6,806,000 tons of nickel-copper at the end of 1938. Net profit for 1946 was (in U.S. dollars) $29,681,352 ($25,010,938).

The name of Acticarbon, Ltd., 175 Piccadilly, London, W.1, has been changed to **British Ceca Co., Ltd.** This, it is explained, is in order to bring the name within the British Empire into conformity with the world-wide organisation, C.E.C.A. (Carbonisation et Charbons Actifs), whose patented and technical processes are used.

Referring to export inquiries, the chairman of **Savory and Moore, Ltd.**, Mr. E. T. Neathercoat, at the annual meeting, spoke of " every indication of a continuance of the sellers' market for a time," but added: " To do this export trade successfully, the chemical industry needs more official help and less hindrances. We need more general facilities for contacting foreign merchants."

A substantial increase in sales, including export, the value of which has shown an increase of 46 per cent over 1945, is reported in the annual statement of **Chinnor Cement and Lime Co., Ltd.** Trading and net profits for 1946 were both up, the net figure being £25,136 (£7663).

The combined trading profit in 1946 of **British Xylonite Co., Ltd.**, and subsidiaries was £1,143,513 (£707,050), with a consolidated net profit of £245,776 (£89,479). Gross income of British Xylonite was £105,619 (£97,475), with a net profit of £49,900 (£40,773). The final dividend is 15 per cent, making a total of 20 per cent (10).

New Company Registered

Powell Duffryn Technical Services Ltd. (430,855).—Private company. Capital £50,000 in £1 shares. To undertake technical, commercial, financial and administrative investigations; to provide consultative and advisory services in relation to the evaluation, development, exploitation, utilisation and turning to account all forms of chemical and physical energy; prospecting and mining for coal and other mineral fuels, the conversion of primary sources of energy into electrical, mechanical and thermal energy, etc. Directors: R. Foot, E. Hann, H. Merrett, J. Bennett, W. Boon. Registered office: 40 Lime Street, London, E.C.3.

Chemical and Allied Stocks and Shares

DOMINATED by holiday influences and the approaching Budget, business in stock markets was inclined to dwindle, although, helped by the Gilt-edged rally, the general tendency became firmer. A good impression was created in the city by the F.B.I. statement on current problems. There are increasing indications that earnings of a large number of companies are being affected by fuel and steel shortages and that the latter must in due course be reflected in export trade.

Industrial shares were assisted by the Imperial Chemical higher payment. An increase had apparently not been generally expected, although as was pointed out recently in these notes, there seemed scope for this, bearing in mind that the total annual payment has been limited to 8 per cent ever since 1938. The 8 per cent dividend is now being accompanied by a 2 per cent bonus, making 10 per cent, the highest annual total in the company's history. The profit figures have also been well received, but the full results and annual statement will have to be awaited for indications as to whether the higher 10 per cent can be regarded as likely to be repeated. The prevailing view is that it will probably continue to be the practice to keep the dividend at 8 per cent and to pay a bonus in any year when this is considered to be justified.

The higher I.C.I. payment follows increased payments this year by a number of other leading companies, including Borax Consolidated and British Aluminium. In the case of the I.C.I. expansion in export trade has probably been of considerable benefit to the results, although as recent rumours have been suggesting, foreign competition in export trade must be expected to grow as time proceeds. Fears of this recently caused an easier trend in Imperial Chemical ordinary units, but immediately following the dividend statement, the price jumped 4s. 6d. to 47s. 6d. Yield at this level works out at 4¼ per cent, which seems attractive, when compared with the average return on other leading industrial shares.

Elsewhere, W. J. Bush were 92s. 6d., Fisons 61s., and British Drug Houses 58s. 9d., Greeff-Chemicals Holdings 5s. ordinary held their recent rise to 14s. Imperial Smelting strengthened to 20s. 7½d., and there was a rally to 84s. 6d. in Turner & Newall, the tendency being to favour shares of companies with important export business or overseas interests. Borax Consolidated were 57s. 9d., while there was a revival in British Aluminium which rallied to 47s. 6d. on the higher metal price. Dunlops were also better at 70s., and Triplex Glass firmed up to 35s. 3d.

Iron and steels turned easier with Hadfields 26s. xd, Allied Ironfounders 61s. 6d., Guest Keen 47s., United Steel 26s. 7½d., and Dorman Long 28s. On the other hand, textiles firmed up, Bradford Dyers being 23s. 10½d., Bleachers 12s. 6d., and Calico Printers 20s. 3d. There was less activity in shares of companies with plastics interest. De La Rue were 60s. ex rights to the new shares, with British Industrial Plastics 2s. ordinary firm at 8s. 9d., and in other directions, the units of the Distillers Co. were 132s. 6d. Boots Drug were 61s., Timothy Whites 48s., and Sangers 34s. 6d. Oil shares failed to hold all earlier gains, but Anglo-Iranian were good at £7½, and Shell £5½.

British Chemical Prices

Market Reports

MANCHESTER.—Very firm price conditions continue to be reported in all sections of the Manchester market for both light and heavy chemical products. Further substantial advances in the leading non-ferrous metals will inevitably leave their mark on quotations for the lead, copper and tin products. The alkali products generally are meeting with a steady demand, and a full absorption of supplies of the potash chemicals is also reported. There is pressure for deliveries of many descriptions of fertilisers, including sulphate of ammonia and superphosphate. The demand for the principal tar products, both light and heavy, continues at a good level.

GLASGOW.—There has been little improvement in the Scottish heavy chemical trade during the past week. The effects of present road and rail conditions have added to the difficulties of obtaining supplies already being experienced as a result of the fuel crisis. Inquiries in the export market continued firm. Buyers in Greece are finding difficulties in obtaining import licences.

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Patents in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Complete Specifications Open to Public Inspection

Alkamine esters of pyrrole substituted acrylic acids.—American Cyanamid Co. July 31, 1943. 12005/44.

Plastic compositions.—Carbide & Carbon Chemicals Corporation. June 11, 1943. 9903/44.

Lubricating grease compositions.—Carbide & Carbon Chemicals Corporation. Aug. 22, 1945. 23095/46.

Aromatic compounds.—Dominion Tar & Chemical Co., Ltd. Aug. 21, 1945. 31549/45.

Penicillin.—Eli Lilly & Co. Aug. 24, 1945. 20799, 20987, 22087, 22144/46.

Antibiotic production.—Eli Lilly & Co. Aug. 24, 1945. 21830/46.

Recovery of water soluble plant substances such as ascorbic acid, and also fat soluble vitamines, pro-vitamines and non-saponifiable constituents, other than vitamines and pro-vitamines from chlorophyl-containing parts of vegetable materials.—A. Heilmann. Aug. 24, 1945. 23903/46.

Interpolymers of vinyl thiolesters.—I.C.I., Ltd. July 30, 1943. 14597/44.

Hydrogenating carbon dioxide.—M. W. Kellogg Co. Aug. 23, 1945. 21791/46.

Thieno uracils.—Lederle Laboratories, Inc. Aug. 10, 1945. 22953/46.

Chemical compounds.—Merck & Co., Inc. —Aug. 24, 1945. 22455/46.

Hexitols or mixtures of isomeric hexitols by the catalytic reduction of carbohydrates. N.V. W. A. Scholten's Chemische Fabrieken. Jan. 30, 1942. 1645/47.

Raising the concentration of heavy water. Norsk Hydro-Elektrisk Kvaelstof-A/S. Dec. 21, 1942. 929/46.

Glycerin and distilled fatty acids.—Procter & Gamble Co. Aug. 24, 1945. 22735/46.

Continuous production of crude glycerin. —Procter & Gamble Co. Aug. 24, 1945. 22736/46.

Acid derivatives from unsaturated compounds.—Röhm & Haas Co. Aug. 18, 1945. 9870/46.

Azo dyestuffs.—S.A. de Matiöres Colorantes et Produits Chimiques Francolor.—Aug. 24, 1945. 22738/46.

Extraction of alkaloids, glucosides, etc.—Usines Chemiques des Laboratoires Français. Aug. 20, 1945. 25484/46.

Butylene glycol and acetyl methyl carbinol.—Usines de Melle. Aug. 20, 1945. 22662/46.

Water-soluble methylol melamine condensation products.—American Cyanamid Co. Aug. 25, 1945. 21921-24/46.

Quaternary salts of dimethylures monoethers.—American Cyanamid Co. Feb. 12, 1943. 2399/44.

Removing contaminating salts from cellulose-fatty acid ethers.—Ciba, Ltd. Aug. 27, 1945. 23986-87/46.

Evaporating metals.—W. H. Colbert, and A. R. Weinrich. Sept. 1, 1944. 20177/45.

Detergents.—Davison Chemical Corporation. Aug. 29, 1945. 23317-17/46.

Kite balloons.—Dewey & Almy Chemical Co. Aug. 31, 1945. 10444-45/46.

Stabilisation of paraformaldehyde.—E.I. Du Pont de Nemours & Co. Aug. 29, 1945. 25953/46.

Art of polymerisation and method of polymerising vinylidene-group-containing liquid monomeric compounds.—Glenn L. Martin Co. Aug. 31, 1945. 9437/46.

Making secondary polyhydroxyalkylaryl amines.—Hoffmann-La Roche, Inc. Dec. 15, 1944. 5140/46.

Cellulosic materials and articles having improved chemical and physical properties. I.C.I., Ltd. July 10, 1943. 13119/44.

Copolymerisation products of homogeneous composition.—N.V. de Bataafsche Petroleum Maatschappij. Aug 28, 1945. 35284/45.

Liquid fuel burners.—N.V. de Bataafsche Petroleum Maatschappij. June 6, 1944. 3848/47.

Coatings on aluminium and its alloys.—American Chemical Paint Co. Sept. 6, 1945. 26896/46.

Compositions for the prevention and destruction of weeds.—American Chemical Paint Co. March 20, 1944. 4604-5/47

Melamine.—American Cyanamid Co. Sept. 5, 1945. 25784/46.

Preparing pure alkali metal salts of penicillin.—Commercial Solvents Corporation. Sept. 4, 1945. 24623/46.

Preparing pure crystalline salts of penicillin.—Commercial Solvents Corporation. Sept 4, 1945. 25190-91/46.

Refining penicillin, G.—Commercial Solvents Corporation. Sept. 4, 1945. 25789-90/46.

Refining penicillin, X.—Commercial Solvents Corporation. Sept. 4, 1945. 26327-28/46.

Blends of polymedic materials.—E.I. Du Pont de Nemours & Co. Sept. 6, 1945. 26842/46.

Preparing 2-sulphanilamidopyrazine.—Mead Johnson & Co. Feb. 5, 1941. 2444/47.

Ammonium salts of nitro or halogen derivatives of phenols or naphthols.—N.V. Fabriek Van Chemische Producten. Nov. 17, 1944. 3214/47.

Burning vaporised hydrocarbons.—N.V. Philips Gloeilampenfabrieken. May 31, 1944. 2893/47.

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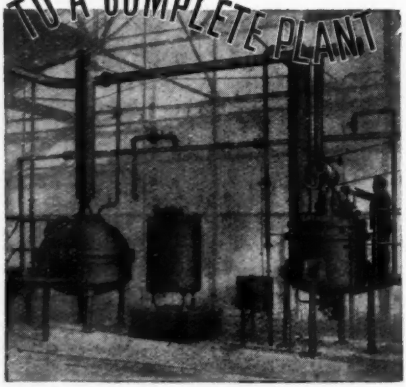

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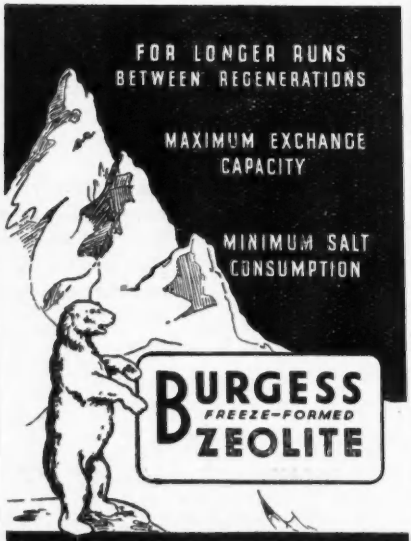

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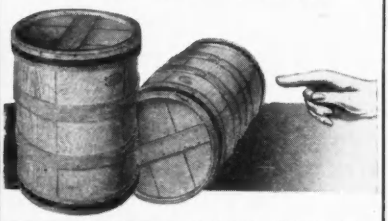

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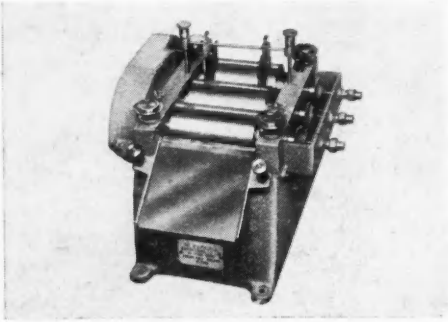

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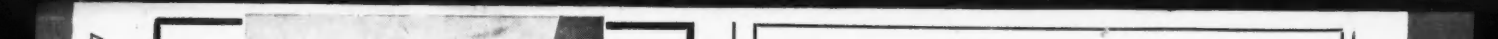
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